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LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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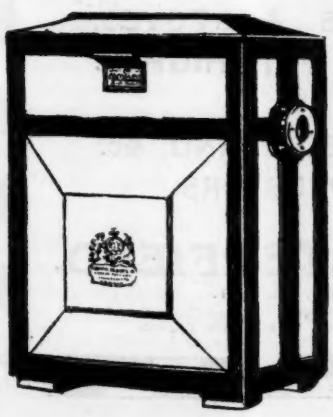

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VOL. CL., No. 2977.] TUESDAY, JUNE 1, 1920. [72ND YEAR.

EDITORIAL NOTES.

Further Examination of the Bill.

A SECOND examination of the Gas Regulation Bill does not in any way induce us to withdraw from the views expressed last week on its provisions. On the contrary, points which the second examination reveal harden our view that, with a little trimming-up, there is the making here of a very good Act for the industry, its customers, and its workers, whose interests are largely one. In effect, the Bill contemplates constituting the Board of Trade a Ministry of Gas, with Gas Referees as advisers on technical matters, and a Chief Gas Examiner as arbitrator when dispute arises as to a question of penalty for delinquencies. It is an absurdity to suppose that the powers that will be conferred upon the industry through the Bill could be obtained and exercised without some supervision and control. We know there are men in the gas industry who would prefer to apply for an Act of Parliament to secure the powers, instead of for an Order to the Board of Trade. We do not know what their objection is, or the grounds of their preference; but such men are in the minority. The fact remains that if the process of obtaining the powers is by Act of Parliament, the revision of the financial terms and the alteration of the declared calorific value would be, in the Special Act, entrusted to the Board of Trade. We have seen, too, that in the South Metropolitan and South Suburban Bills, the Companies have to submit in five years' time, for reconsideration and (if necessary) adjustment, the terms allowed in the Bills if they, as they stand at present, pass to the stage of Royal Assent.

We feel that in this matter the Board of Trade have proved themselves well worthy of the confidence of the gas industry; and that their decisions will be fair and just, the existing Bill is, in our opinion, an earnest. In several of its parts, the provisions are sufficiently wide to enable all concerns and any special circumstances to be taken into account. This suggests individual treatment. It is a big job that the Board of Trade are proposing to take in hand in adjudicating upon the post-war position of every undertaking in relation to its pre-war terms; and this within a period of two years. Thereafter will be taken into account the affairs of those gas undertakings that have not made application for establishing themselves on the new basis. The heat-unit method of doing gas business is to be made common; and financial conditions are to be adjusted to the circumstances of the change and the times. When the Bill becomes an Act, and it is brought into operation, those who stand in pressing need of revision will make the earliest application; but just as gas undertakings will expect the Board to deal honestly by them, so the Board will expect gas undertakings not to present a case that is painted worse than it need be. Such a case would naturally and properly draw special attention to itself, and invite critical examination; and the result might be—and again rightly so—an effect just the opposite to that intended. The opportunity for presenting a case for revision will always be a protection; and procedure through the Board of Trade in respect of the application and subsequent revisions will be a cheaper process than by proceeding through Parliament.

Therefore, we are not prepared in any way to criticize adversely the general structure of the Bill, but only to plead for modification or excision in respect of certain details, when, after the second reading, the measure is referred to a Standing Committee. The limitation of inerts to the extent recommended, and in any degree in fact, is a matter that has been largely and strongly resented in the industry. The researches of the Gas Investigation Committee have shown that inerts have little to do with the efficiency of gas in use. It is worth observing that the Bill, as drafted, gives the Board the power to say whether or not there shall be a limitation of inerts. Condition III. of clause 2 says: "It [the gas] shall not, *if so prescribed by the Order*, contain "more than the permissible proportion of incombustible "constituents." Then, again, in sub-section 3 of the same clause, it says: "*Where an Order provides* that the gas "supplied by any undertakers is not to contain more than "the permissible proportion of incombustible constituents." If the words we have italicized mean anything at all, it is that the Board are only providing for discretion in the matter, and not for compulsory application of limitation. This being so, and the sale of gas being transferred to the heat-unit basis (so protecting the consumer), would it not be better to expunge the inerts clause altogether? This will be a subject for the Standing Committee to consider; and we should think there will be very little difficulty in satisfying them that there is no necessity for the restriction. Whether the inerts in the gas are limited or not, before the gas can undergo complete combustion, there must be a quantity of air used, which, in itself, contains an enormous proportion of inerts; so that, if the heat units are supplied, the restriction of inerts in the gas would make a negligible difference—certainly not such a difference as to require legislation and constant chemical tests to maintain the volume within the prescribed bounds. The proposal is a fine illustration of supererogation. Another point that needs amendment is the minimum permissible pressure. Sub-section 2 of clause 2 provides: "The minimum permissible "pressure shall be such pressure in any main or service-"pipe of 2 inches diameter and upwards as to balance a "column of water not less than 2 inches in height, except "as may be otherwise provided by the Order relating to "any undertaking." Words should be introduced into this clause to make it quite clear that only service-pipes before the meter are intended to come under the provision.

The Bill, of course, is in no sense an agreed one; so that the gas industry is fully at liberty to seek revision. There are details as to testing and penalties which require co-ordinating. Before alluding to them, there is the question of the prescribing and supervising machinery—the Gas Referees, Chief Gas Examiner, and Examiners, who are indispensable to the industry in giving satisfaction to the public that gas undertakings are acting up to their declarations and bargains, within the prescribed limits. As we pointed out last week, what is proposed in the Bill is nothing more than the application to the whole country of what has been in operation for the past fifty-two years throughout the Metropolis. In our opinion, it is better to have one system of prescription and supervision in existence all through the industry. Touching this question is that of the "gas fund" which is to be created for discharging the expenses in this matter of the Board of Trade, the Referees, and the Chief Gas Examiner. It will be seen that the Bill proposes that the maximum contribution shall be £15 per 100 million cubic feet manufactured by undertakings producing not less than 100 million cubic feet per annum. The maximum contribution is a liberal one; for we calculate that if this rate was fixed, the contribution of the Gaslight and Coke Company alone would be not less than £4800 a year, as com-

pared with (we believe) £1600 per annum under the existing Metropolitan system. The Bill, however, proposes that the Board of Trade shall each year prescribe a rate of contribution which shall not exceed the estimated reasonable requirements for the year. There is no objection to this, as it must in the nature of things be a rare year in which the maximum contribution will be needed; though, with the work that will have to be done in placing gas undertakings on the new basis, the first two years or so will naturally call for heavy work and unusual expenditure. We know there has been a desire to ease the burdens of the smaller gas undertakings, and to relieve them as much as possible of any new liability. But if the Bill is of real advantage to them, then contribution should be extended to all *pro rata*, because it seems hardly right that consumers in the large cities and towns—there are only some 300 concerns making upwards of 100 million cubic feet a year—should be called upon to bear the expenses of consumers in this regard elsewhere. That is what the Bill as it stands means. Of course, we see that collection would be a matter of less difficulty the fewer the undertakings making contribution. However, expansion of the basis of contribution is a matter for consideration. Then another point is that the contribution, in our judgment, should be levied not on the gas "manufactured," but on the gas "sold"—the gas sold on the heat-unit basis, and not in addition on the gas used on the works and unaccounted-for.

As to clause 9, dealing with the forfeitures for deficient calorific value, there is something there that appears to be anomalous. By sub-section 1 there are to be no forfeitures if the gas is not more than 5 p.ct. below the calorific value; and in the event of its being upwards of 5 p.ct., the forfeiture is not to exceed £5 for every complete 1 p.ct. by which the calorific value is deficient. There is no objection to the 5 p.ct.; a margin is necessary in view of variations in the quality of coal and other circumstances which may temporarily affect the calorific value. But then the safeguard is removed and complication introduced by sub-section 4, which provides that, if in any quarter the average calorific value of the gas supplied by the undertakers is less than the declared calorific value, a sum which the Chief Gas Examiner shall determine to be as nearly as may be the amount by which the revenue of the undertakers has been improperly increased shall, in the case of local authority undertakings, be applied to the reduction of the price of gas, and, in the case of companies, be deducted from the divisible profits; and the dividend which the undertakers may pay on their ordinary capital shall be correspondingly reduced. The sum might in certain events amount to a very large one; and we do not see why the dividends of the shareholders should have this extraordinary element of uncertainty introduced into them. It is unchallengeable that, if we are to sell on the heat-unit basis, the consumers should only pay for the heat units supplied; but a method of compensation should be devised other than by directly penalizing the shareholders, and inflicting an injury upon their investments. This is a matter (among others to which we have referred, together with some minor details) that will require consideration when the Bill gets before the Standing Committee, as it ought to do shortly, if the proposal is carried out that the Bill shall be submitted for second reading on the reassembling of Parliament this week.

Coal Decentralization and then Decontrol.

It is hoped by the authorities that before long decontrol of coal will set in. But the hope is based only on the unknown results of experiment which is to commence to-day. Decentralization of control from London to the districts, with limitation of exports, is the method adopted to pave the way to the goal. The coal industry is welcoming the evidence of a desire to decontrol distribution as early as possible; and the spirit in which the decentralizing proposals have been received bids us believe that no effort will be spared by the colliery owners, provided there is the requisite output on the part of the men, to hasten the day of freedom in the disposal of their product, if not freedom at the same time in the matter of prices. Before decontrol in distribution can take place, however, there is a great deal to be done. It is quite clear that the inland coal supplies are not at present adequate for the domestic and trade requirements of the country; and the reasons for this, as given by Sir Adam Nimmo, are that the output for various reasons (principally the reduction of the working hours of the miners) is much less than in 1914, and that the demand is greater for industrial purposes. To partially meet this condition, more coal that would have been exported has been retained for home use. But that old incubus to all longings and efforts in this direction—the gravity of transport difficulties—still interposes itself. These difficulties have to be cleared away before coal decontrol can come. Coal decontrol therefore rests upon the joint efforts of the collieries (including the miners, who we are not sure altogether wish it) and the Ministry of Transport, working in conjunction with the railway companies. Certain it is that until the domestic and industrial supply of fuel throughout the country is assured, the Government will not sanction final decontrol even of disposal and distribution. Hence, the experiment with the decentralization of control, and the transference of the distribution functions of the Coal Controller's Department to the District Coal Supply Committees. The adequacy of supply and delivery will be the test of safety in entering upon coal decontrol.

So far as the gas industry is concerned, it will welcome any change that will give to it more satisfactory supplies. Recognizing all the difficulties of the Coal Controller, and the immensity of the work involved by centralized control, responsible gas men can say they have not grumbled and persistently invoked the aid of the Controller without good cause, and that cause the public interests and convenience. Nor have they had altogether happy experience with the District Supply Committees; but now these bodies are to be strengthened, and their authority increased. The new state cannot possibly be worse than the old; and it is to be hoped that one result of the closer intimacy between coal authority and coal receiver will be that more suitable qualities will be forthcoming for gas-making purposes. It is hinted that it may be necessary, in order to ensure adequate supplies to all fuel users, to further alter the distribution of coal, involving a change of customers. If this is so, although it will mean a little more disorganization, we hope it will result in the allocation of coal of suitable qualities. Unsuitability is an old grievance during control which there has been little attempt to remedy by the controlling powers. But whatever changes there are to be in the sources of supplies for any gas undertakings, they would rather have to deal with them now than later in the year. The proposal as to redistribution is the object of the questionnaire that the National Gas Council, acting in collaboration with the Federation of British Industries, have circulated among the gas undertakings of the country, and to which reference was made in a paragraph in last week's "Journal." Through the organization of the Federation, it is intended to make a definite attempt to improve the distribution of coal on the basis of quality and desirable characteristics for special purposes. Other industries, with considerable influence, are interested in this matter as well as the gas industry; and therefore the information desired should be supplied. The better the organization of forces, the greater the proof and pressure, the more is good effect likely to be produced in relation to the supply of coal of the quality most suitable to the purpose.

The Dividend on the Old Stock.

We have met a good many people in the gas industry since the decision was given by the House of Lords Committee on the South Metropolitan and South Suburban Gas Companies' Bills, who have expressed the opinion that the 5 p.ct. granted as the minimum dividend in the first case on the old ordinary stock and as a standard dividend in the second case is quite inadequate. This view is in harmony with that submitted in the "Journal" for May 18. Both the stocks were getting higher dividends in pre-war days—the South Metropolitan close upon 5½ p.ct. and the South Suburban 6 p.ct.; and the prospects were that better dividends still would have been earned had there been no war. But now, with the current still flowing to higher working costs, any hope of getting above the prescribed 5 p.ct. by the operation of the new profit-division system in the case of the South Metropolitan Company, and by the action of the sliding-scale in the case of the South Suburban Company, appears altogether vain. Here at once the proprietors are deprived of part of the dividend which they were receiving before war difficulties intervened; and this is a deprivation of income that, however viewed, is a clear injustice. It comes, too, on top of the slender dividends that have prevailed throughout the war years upon their stocks, for which

in most cases premiums were paid. Market values have been depreciated by 40 to 50 and more per cent, and they can never recover their old position with merely a minimum or standard 5 p.ct. dividend. Everything the stockholders lost through the war—not through inefficient management on the part of those to whom they entrusted their business—they deserve to have restored to them by the operation of new and adequate terms. Five per cent will never bring about a revival of the old values with working costs at their new level, and with the likelihood of this level going higher still. We can well imagine the Chairmen and Directors of the Companies considered anxiously and long whether or not they should accept the 5 p.ct., or withdraw the part of their Bills dealing with financial revision. No announcement has been made as to withdrawal; so that the Bills in their entirety are going on to the House of Commons—this notwithstanding that the 5 p.ct. is totally opposed to the evidence of the financial authorities whom the South Metropolitan Gas Company called to Westminster to support their appeal for a minimum dividend of 6 p.ct. Sir William Plender said that the 6 p.ct. dividend could not be regarded as "unreasonable." Sir Henry Goschen considered it was necessary to fix a minimum dividend of 6 p.ct. in order to get the public to subscribe. Mr. F. I. Pitman saw strong objections to having differentiation in the rate of dividend on the old and new stocks; and with this view Sir Herbert Hambling agreed. Yet the Lords Committee rejected the evidence of these authoritative and experienced men, and differentiated between the old and the new stocks by reducing the rate of dividend on the former to 5 p.ct. The decision is opposed to common sense, to expert judgment, and to justice.

There may be existing stockholders who will now wonder whether greater justice would not have been done to them under the Gas Regulation Bill, when it becomes an Act. Of course, it is all a matter of speculation. The Bill is not yet an Act. It has to pass through the parliamentary mill; and it may be changed in form and in character. There is in its clauses nothing definite as to dividend. There is discretionary power; and nothing more than this could be fixed with the varied conditions of undertakings and with their different classes of stock. Sub-section 3 of clause 1 states that "the Order may make such modifications of any "provisions whereby the rate of dividend payable by the "undertakers is dependent on the price of gas supplied, as "appear to the Board to be necessary." It will all depend on the factors that the Board consider it necessary to take into account when considering what dividend modifications should be made. But, previous to the quoted words, there are others which are intended to empower the Board to prescribe a price per therm corresponding to the prices fixed by the statutory provisions for each 1000 c.ft., "but with such "addition (if any) as appears to the Board reasonably "required in order to meet unavoidable increases since "June 30, 1914, in the costs and charges of, and incidental "to, the production and supply of gas by the undertakers." This proposes to establish a principle in fixing the standard price per therm which, in fairness, should be applied to the fixing of the minimum or standard dividend on the old stock. All that the stockholders have lost through unavoidable increases of costs is the lowest measure of what should be restored to them, although it may not be the measure of the additional dividend to which they could also justly lay title owing to the changed value of money. We hope the Board of Trade will not be guided by the decision of the Lords Committee; but that in relation to dividends, if they are given by Parliament the power that is sought in the Bill, they will exercise the judicial authority conferred upon them, and deal in an equitable spirit with those who have supplied the capital to provide the service of gas for the community, and who have suffered so acutely and heavily from cast-iron statutory conditions during the past six years. The new Bill provides for greater elasticity in the future.

Perhaps good ground may be provided for the stockholders of the South Metropolitan and South Suburban Gas Companies wishing that their Directors had, after all, waited for the General Bill and a decision by the Board of Trade. From the Board gas undertakings will not ask for any special indulgence on behalf of their existing stockholders, but they will seek and expect justice; and, in the exercise of justice, it is to be hoped that the Board, when duly empowered to act, and that independently, will not tolerate any outside interference.

Sulphur Reduction without Plant Redundancy.

THE conditions essential for oxide purification to produce good results, and the data necessary to secure effective control, are discussed by Mr. G. Weyman, M.Sc., in a paper that he read last Saturday at the Auxiliary Meeting of the North of England Gas Managers' Association. The proof of good working is found in results; and that the purification principles are good that are applied at Newcastle is shown by a paragraph in the paper, which is of exceptional interest at a time when, in one of the House of Lords Committee Rooms, we have been hearing of the value of the catalytic purification process, and the claim that some consideration should be shown to the stockholders of the South Metropolitan Company if the degree of gas impurity is reduced below a given datum line. The paragraph in Mr. Weyman's paper to which reference is made mentions that attention has several times been drawn to the fact that sulphur in the purified gas from oxide purification may be very low. The method of elimination is not known. It may be in the form of thiocarbonate; but investigation does not warrant the acceptance of this explanation as the whole truth. However, the sulphur in the gas from the Newcastle and Gateshead Company's works has been for months on end reduced to from 5 to 10 grains per 100 c.ft. The conditions obtaining during the period are good working purifier temperatures, use of steam, oxide slightly acid, and from 1 to 2 grains of ammonia passing into the boxes per 100 c.ft. of gas. When for test purposes the conditions were varied, up went the sulphur content of the gas—in some cases to above 30 grains. Ammonia is essential; but above the quantity referred to, it does not seem to give better results. These particulars are practically as Mr. Weyman gave them; and they show clearly that, for all practical purposes, gas can (the proper conditions being adopted and maintained) have its sulphur brought down to a degree by oxide purification over which the most ardent gas super-refiner cannot cavil. Towards the end of the first editorial in the "JOURNAL" for May 11, allusion was also made to the reduction of sulphur by the oil-washing of gas for benzol. It was then remarked: "We have some "figures before us which disclose that, in the case of an "undertaking which oil-washes its gas for benzol, working "only to about 1½ gallons, there is a reduction of between 50 "and 70 p.ct. in the sulphur compounds in the gas, without "the aid of the catalytic process." All this goes to show that there are ways and means of attaining sulphur reduction without plant redundancy.

Share and Stock Holders and the Bill.

We do not think that gas share and stock holders require much pressure (after the pinch they have been and are experiencing in the matter of dividends on their investments) to do all they can to help forward that measure of justice—the Gas Regulation Bill. Every gas share and stock holder has a personal interest in the measure. Fair dividends and better market values can only be realized by the help of the Legislature. Every single holder of gas shares or stocks, if he or she took the advice of the directors of the companies in which he or she is concerned, was towards the end of last week busy signing a petition in favour of the Bill, and informing members of Parliament of the position of things in the gas industry. Without such information, members of Parliament cannot be expected to appreciate the points of such a deplorable situation as that which exists in the industry at the present time. The second reading of the Bill, it is expected, will be taken to-morrow; and it is vital to the interests of the industry that it should pass through Parliament, and become law, and that as quickly as possible. It is as important to the proprietors of the South Metropolitan and the South Suburban Companies as to other gas companies who have not promoted Special Bills for the purpose of securing the adjustment of prices and dividends to current circumstances, though stock holders in the two Companies named have not received any advice from their respective Boards urging them to do all in their power to support the Bill. It is unquestionably much better for the stock holders in these Companies to have two strings to their bow. In the event of the stoppage or failure of their own Bills in respect of financial revision and the heat-unit basis of charging, it will be well for the stockholders of the Companies to have the Gas Regulation Act to fall back upon; and, anyway, if the two Companies are

successful with their Acts, the machinery provided by the General Act will be required by them when it comes to the revision of the terms granted by the Private Acts.

Standard of Profits and Corporation Tax.

It can be claimed that the Federation of British Industries are much on the side of the gas industry in its quest for financial relief. No man of commerce or finance could possibly be otherwise. Right away from the passing of the Temporary Increase of Charges Act, from such men (though not associated with the gas industry) there has been nothing but ridicule over the then notions of Parliament as to what was necessary in the way of dividends to maintain the stability of gas undertakings and their attractiveness to investors. Just recently the Executive Committee of the Federation passed instructions for their Taxation Committee regarding various amendments which it should be their endeavour to secure at the Committee stage of the Finance Bill. One of these referred to the revision of the standard of profit. In view of the altered value of money and the remoteness of the pre-war period, it was suggested that provision should be made to enable a reasonable revision of the standard of profits. All businesses, the Federation hold, should be allowed an increased percentage for capital—old as well as new; and there should be revision in the case of businesses where the statutory percentage of profit is not a reasonable return in these new times. Another point the Taxation Committee were requested to endeavour to get safeguarded is, in connection with the Corporation tax, the position of companies whose charges are limited by statute.

Corporation Tax and Statutory Stockholders.

The Railway Companies' Association have set an example to the representative bodies of other statutory industries. They have sent a deputation to the Chancellor of the Exchequer to urge the view that exemption from the proposed corporation tax should be given to railway companies. Among the points made by the deputation was that the tax would inflict great hardship on ordinary stockholders, composed of large numbers of people with small incomes, who, although paying their share of increased taxation, had not participated in the general increased remuneration received by every other form of business undertaking. Attention was drawn to the fact that the rate of interest on railway stock was already very low, and that any further reduction would make it impossible to raise capital for the extension of railways which is now absolutely essential to meet urgent traffic requirements. The case that was submitted fits equally the condition of gas companies. Of course, the Chancellor could not do anything more at the time than promise to give the matter raised earnest consideration.

Railwaymen and Industry's Costs.

If the railwaymen get all they want, it is inevitable that the cost of industrial and commercial traffic will again ascend. The money has to come from somewhere; and it is more likely to be drawn from industry and commerce than from the individual. The burdens of industry certainly need no further weighting if the country is to attain the maximum speed and volume in production and trade. The claim advanced by the National Union of Railwaymen is for £1 a week rise for all grades of their members, and that of the Associated Society of Locomotive Engineers and Firemen is for an increase of 21s. per week for engine drivers and motormen, 15s. for firemen, and 10s. for cleaners. These claims have no connection with the cost of living. They are something superincumbent. The rises and falls in the cost of living are provided for in the agreement entered into in January last, whereby the economic value of wages is maintained by an automatic increase of 1s. per week for each five points rise in the cost of living on the pre-war figure. The percentage is now 141; and the men are entitled to a further 2s. per week, which the Central Wages Board are to be asked to grant immediately. This will make the flat-rate advance on the pre-war wage £2 1s. per week. There are in these days no falls in the average percentage cost of living; and there are not likely to be for a long time, what with rents, coal, bread, and other things going up. But the Railway Unions are not satisfied with essential costs being met; they must have something over and beyond, even though it costs the country from 28 to 35 millions a year extra, and weakens its industrial power to that extent. The men's representatives had no clear reply to make to the case as to these claims working an injury to the country. If granted the gas industry with all its coal, coke, and secondary products carriage will feel very acutely the extra expense, as it is doing with the current transit costs. It is expected that the National Wages Board will communicate their recommendations to the Ministry of Transport within the next week.

The Miners' Average Output.

The miners' representatives fight shy of the fact that precedent proves conclusively that the men are not to-day doing their utmost in the matter of output. We have frequently pointed out that the number of men now employed in the mines is greatly in excess of the number employed before the war; so that allowing for the reduction of one hour per day, the aggregate output of coal should be somewhere about that in pre-war years. If the output continued at the rate that obtained in the first quarter of this year, it would only represent 200 tons per man a year; whereas (according to statistics in the "Iron and Coal Trades Review") it should be 270 tons, less one-eighth for the reduction of working hours to seven, or 237 tons. If the men would only work so as to give this output, it is calculated there would be another 38 million tons of coal available for disposal. The increased production would also bring down costs. With the summery weather, however, output is again on the decline. In the week ending April 24, it was 4,989,666 tons; in the week ending May 1, 4,564,564 tons; and in the week ending May 8, 4,674,302 tons. These figures do not bid us hope for an improvement in the annual output per man. It is estimated that, as things are, only 24 million tons of coal will be available for export this year, after provision has been made for home requirements and bunkers. Exports have been falling alarmingly. In the four months ending April, 10,361,664 tons were shipped, compared with 11,507,536 tons in the same period last year, and 23,589,878 tons in the like period of 1913. Coke has been doing better. In the four months, 786,159 tons were exported, which is more than twice as much as was shipped in the same period of 1913.

Busy Times in Company Registration.

In many quarters, part of the blame for the present drooping condition of affairs in the more speculative sections of the stock markets has been freely laid at the door of the recent boom in company prospectus issues. Anyway, that the business of company promoting has been extraordinarily brisk is common knowledge; and figures quoted in a survey and analysis of companies registered in the United Kingdom during March and April, which appears in the current issue of the "Stock Exchange Gazette," will be noted with interest. The companies registered in March numbered 1352, with capitals aggregating 125½ millions; and though there was a falling-off in April, even then the 985 companies registered had a total capitalization of close upon 90 millions. After the new duties were imposed on April 20, there was a decrease in the number of registrations; but it is remarked that for many reasons the first few weeks of the new régime cannot be taken as a criterion. When all the company schemes which were in preparation before April 20 have either been consummated or abandoned, one will begin to see the real effect of the new company duties on registration. One thing which our contemporary finds has happened in various cases in connection with documents printed before April 19 is the reduction of proposed nominal capitals. In many instances—especially of the smaller concerns—alterations have been made in writing, and initialled by the subscribers; and if the same process (carried out by printing fresh copies of the documents, and therefore undiscoverable) has been going on with regard to the bigger ventures, says the writer of the article, the new impost will largely have defeated its own principal object, which is revenue.

Lecturing at the Birmingham Chamber of Commerce, to members of the local Metallurgical Society, on "Model Metal Melting," Mr. A. J. G. Smout enlarged on the theory that, as a result of healthy competition, more rapid progress would be made between the various fuels which could be employed; and he suggested the possibility of more efficient methods in utilizing coal in various directions. He doubted whether they were on the right lines in converting coal into gas, and subsequently burning it in the ordinary gas-fuel furnace, when greater efficiency could be obtained with firing by means of pulverized coal or producer gas, on a regenerative or recuperative system.

THE INSTITUTION OF GAS ENGINEERS.

MEETING TUESDAY, JUNE 1, 1920.

PRESIDENTIAL ADDRESS DELIVERED BY

Sir DUGALD CLERK, K.B.E., D.Sc., F.R.S., M.Inst.C.E.,

THE FUTURE OF THE GAS INDUSTRY.

Some of our statesmen appear to have formed very erroneous ideas of the future of the gas industry. They think of it as a fully-developed entity—useful in its time no doubt, but now exhausted by its existence of over one hundred years, and therefore incapable of further progress. They consider its capacity for advance inferior or even negligible, compared with its younger rival, electricity. They also fail to understand the magnitude and efficiency of its services to the public, from both the fuel conservation and financial standpoints.

In actual fact, at the present moment the gas industry is highly efficient in the production of light by the incandescent mantle. In the generation and distribution of motive power it is thermally considerably more efficient than electricity; and in the general production of heat for domestic and manufacturing purposes, it is overwhelmingly more efficient than electricity.

As to the future. Developments are impending in the gas industry by no means less important than those in view in the case of electricity. Great developments are coming in both industries, provided that legislative interference is reduced to a minimum, and gas and electricity are allowed to compete freely in the service of light, power, and heat. Thermal and financial factors will then soon determine the selection and division of the three types of service in the most advantageous manner to the country. In such circumstances, gas and electricity will share in distributing light and power, probably in nearly equal divisions; but, for the public supply of heat, gas will take in the future, as it does now, much the greater proportion.

Gas, like electricity, has been greatly hampered in the past by unwise restrictive legislation; and it is to be hoped that impending changes in the law will leave both industries free to develop, so as to render the maximum service to the country.

The gas engineers of the United Kingdom are proud of the past history of their industry; and they are enthusiastic workers for, and believers in, its greatly increased expansion, by improved service to the public. The trend of improvement in generation and use of town's gas has taken two directions within the industry, both capable of high thermal and financial efficiency.

The first method is that of destructive distillation of the coal treated, and the generation of gas by the process—leaving coke in the retort, and collecting tar and chemical products eliminated from the gas before distribution for use. The second method consists in converting a portion of the coke produced into water gas, and adding this gas to the distilled or "straight" gas. This method increases the proportion of total heat of the original coal transferred to the gasholder. The second method has various modifications—such as adding producer gas by steaming in vertical retorts as well as by generating carburetted or plain water gas in separate producers. It also includes processes for the complete conversion of the whole coal into gas now in the early manufacturing stage.

According to the older method, carbonization has been closely studied with a view to the reduction to a minimum of the heat used and lost in the process, so that the whole of the volatile hydrocarbons may be driven-off in the retorts (be they horizontal, inclined, or vertical), and coke and tar with the gas so produced form the products (gaseous, liquid, and solid) from which heat, power, and light may be obtained at a minimum of fuel consumption and of money expenditure.

By this method, on best practice the original heat of the coal dealt with is divided as follows:

Coal gas produced	25	B.Th.U.
Coke produced	54	,,
Tar produced	6	,,
	85	B.Th.U.
Heat used and lost	15	,,
Total original heat of coal	100	B.Th.U.

Assuming the whole of the heat loss to be debited against the gas, then the thermal efficiency of gas production is in this case 62·5 p.ct. This may be taken as the highest thermal efficiency which can be obtained by a gas-making process which consists essentially of destructive distillation. The average efficiency of gas production throughout the country is much lower at present—about 46 p.ct.

Many gas-works adhere to this method of gas generation. The largest of the concerns of this type is the South Metropolitan Company under the leadership of the distinguished gas engineer, Dr. Carpenter. Many gas engineers, however, have increased the conversion of the coal into gas by means of water-gas processes, dealing with a portion of the coke formed in the process. Water gas, with or without oil enrichment, has long been added to the distilled gas to an extent varying from 15 to 40 p.ct.* This has the effect of obtaining a larger proportion of the total heat of the coal in the form of gas in the holder. By this water-gas system, carried out in differing detail methods, the percentage of the total heat as gas has been raised to as high as 30 p.ct. It is obvious, however, that it depends on the proportion of heat lost in generating water gas whether the added heat in the holder is obtained at a higher or a lower thermal efficiency than the original distilled gas.

The largest concern using the water-gas addition is the Gas Light and Coke Company, under Mr. Milne Watson, and the able gas engineer, Mr. Thomas Goulden.

Mr. Stewart recently read a very able paper on the whole question of water-gas production, from which it appears that the best plant when generating water gas only, without oil addition, gives the somewhat low thermal efficiency of 50 p.ct. Obviously, the addition of water gas at 50 p.ct. efficiency to distilled gas generated at 62 p.ct. will lower the efficiency of production of the total gas mixture, though it increases the proportion of the total heat of the coal delivered into the gasholder. From this, it will be seen that it is necessary to save heat and increase efficiency in some way if water gas is to be added in large quantities. Otherwise, the efficiency of production will fall.

Prof. Smithells, Prof. Cobb, and myself, in our joint report discussed this question; and we suggested a method of combining the carbonization or distillation process with the water-gas apparatus so as to avoid the heat losses incidental to double and treble processes. By this, it is possible to utilize the heat of the blowing-up and the heat of the water gas, leaving the incandescent coke for the purpose of carbonization, and also to reduce the radiation and conduction losses to one plant instead of two, while altogether avoiding the loss of the heat of the coke which occurs when coke is discharged from carbonizing plant and quenched, and so has to be heated-up again in the separate water-gas plant. By this device, we considered that to the 25 p.ct. of heat in the distilled gas could be added 25 p.ct. of heat from the water gas generated; so that 50 p.ct. of the heat of the original coal could be transferred to the gasholder—

* During the war as much as 60 p.ct. of water gas has been added.

the joint thermal efficiency of the process being of the order of 80 p.ct.

If the double process be capable of performance in one plant at the same heat loss—namely, 15 p.ct.—then the thermal efficiency of gas production is 77 p.ct., and the distribution of heat in the products is:

Mixed coal gas and water gas	50 B.Th.U.
Coke	30 ,,
Tar	5 ,,
	85 B.Th.U.
Heat used and lost	15 ,,
Total original heat of coal	100 B.Th.U.

Obviously, if the whole of the coal be converted into mixed gas with the same heat loss and use, then the thermal efficiency of production rises to 85 p.ct. Such an efficiency has never to my knowledge been obtained in any water-gas plant yet built. The necessity of using an alternating process of blowing-up and steaming for gas generation makes it improbable the heat loss can be sufficiently reduced.

Although this high value has not been attained, it appears from one of Mr. Stewart's tests that a thermal efficiency of 70 p.ct. has been given by gasification in a modern water-gas plant at one of the works of the Gas Light and Coke Company.

For some years past attempts have been made here and on the Continent to work-out a commercially effective form of gas-plant intended for the complete gasification of coal; and some progress has been made in Holland. In our own country, progress has also been made. An experimental apparatus has been erected at the works of the Grantham Gas Company; and preliminary results of some months' working have been published by Mr. R. G. Shadbolt, the Engineer of the Company, from which it appears probable that a thermal efficiency of complete gasification of 70 p.ct. may be expected when the regular gas manufacturing stage is reached. Similar apparatus is being installed at Normanton, under Mr. Hudson. When these engineers have had experience of a year's working, then complete data will no doubt be published, on which we can judge the advantages and conditions of complete gasification.

I have already pointed out that 70 p.ct. cannot be obtained by the separate generation of coal gas by distillation and the separate production of water gas and its addition to the coal gas. The complete gasification of the coke and tar already shown as 70 p.ct. would give $60 \times 0{\cdot}7 = 42$ p.ct. of the original heat of the coal as water gas and $25 + 42 = 67$ p.ct. of the whole heat of the coal as mixed gas.

The lower efficiency value of the alternate system of water-gas generation has caused engineers to examine other systems of complete gasification, of which the best and most extensively used example is the suction producer, designed to supply gas prepared from anthracite or coke and other carbonaceous bodies for gas-engines utilized for all stationary purposes.

In the early stages of gas-engine development, it speedily became evident that the heat used in the form of coal gas was too expensive to allow gas-engines to compete in cost of fuel with steam-engines of considerable power supplied with much cheaper fuel in the form of heat units generated by the combustion of coal. Notwithstanding the very high thermal efficiency of the modern gas-engine, it could not have been used for even moderate powers, such as 100 H.P., without reducing the money cost of the heat units supplied to it. This necessity brought about the invention and development of gas producers, both pressure and suction. By this means, the cost per heat unit was greatly reduced; and engines up to 1000 H.P. were soon constructed for operation with producer gas. The suction producer working with anthracite or coke is very simple and highly efficient. Air is drawn through a mass of incandescent fuel, carrying with it a certain proportion of steam. As the result of the chemical reaction, carbonic oxide and hydrogen are formed, together with a small proportion of hydrocarbon. Very high efficiencies can be obtained and maintained.

In a test of a Dowson suction producer using anthracite (made, under my superintendence, by my then assistant, Mr. Atkinson Adam), I find that as early as the year 1904 the gas generated contained 89 p.ct. of the heat of the fuel at the gross value, and the average analysis was:

H	= 15·6	36·8 p.ct. combustible.
CH_4	= 1·1	
CO	= 20·1	
CO_2	= 6·1	63·1 p.ct. incombustible.
O	= 0·7	
N	= 56·3	

The calculated gross calorific value was 135·3 B.Th.U. This gas is highly efficient in a gas-engine. Here its low heat value per cubic foot is of no consequence. In the operation of internal combustion engines, speaking broadly, it matters little whether gas be used such as American natural gas, of 1000 B.Th.U. per c.ft. and over, coal gas of 600 B.Th.U., producer gas of 130 B.Th.U., or blast-furnace gas of 100 B.Th.U. Equal thermal efficiency can be obtained by making suitable adjustments for the entering air. That is, if (say) 35 p.ct. of the heat of the gas appears as indicated power with the strong gas, the same proportion of the heat present can be obtained with the weak gas. The total power obtained per cubic foot of cylinder capacity is a little less, however, with the weak gas than with the rich. The rich gas, too, may cause pre-ignition at a relatively low compression; but this can be met by adding a proportion of exhaust gases.

Hundreds of thousands of horse power are now obtained from producer gases with high thermal efficiency. The high efficiency of gas generation has tempted some gas engineers to advocate the production and distribution of such weak gas for generating motive power and for heating generally.

The South Staffordshire Mond Company started many years ago to supply a district with power and heating gas; but the results, although interesting and important from a technical and scientific point of view, cannot be said to encourage the gas engineer engaged in the generation of town's gas. The idea of distributing such gases for power and ordinary heating is very old. The late Sir William Siemens made such proposals in the seventies of the Nineteenth Century. The idea, too, was much favoured by the late Mr. B. H. Thwaite, who first applied waste gas from blast-furnaces to the large gas-engine. Some engineers now favour this idea, notwithstanding very obvious objections; and recent advocacy of very weak gases containing a large proportion of inerts has attracted some attention.

The principal advocate of complete gasification on the gas producer principle, with the accompanying large proportion of inert gases, is the well-known and energetic gas engineer, Mr. George Helps. I have carefully studied his proposals as they appear in his weekly journal and in his lectures and utterances reported in the Technical Press. I have also read through the various patent specifications in which he describes his inventions. I must confess I find it difficult to discover in any precise way in what manner Mr. Helps intends to reduce his fuel consumption and increase the thermal efficiency. It is plain, however, that he attaches special value to the presence of large quantities of inert gases in the gas which he would supply. It is true that the high thermal efficiency of the suction and other gas producers depends upon the fact of internal heating due to the partial combustion of carbon within a generator, and the decomposition of the steam accompanying the air by the incandescent carbon. For this method, it is necessary to allow a large proportion of inerts, in order to obtain complete gasification and high thermal efficiency. Mr. Helps appears to consider, however, that many of the advantages of a high-efficiency gas can be obtained by adding atmospheric air to ordinary coal gas distilled from coal in a retort in the usual way; and moreover he draws conclusions as to low thermal value gas from mixtures of such gas and air. He considers atmospheric air as an inert body, and reasons accordingly. This procedure is quite erroneous. I appreciate Mr. Helps's enthusiasm and good intentions; but here he is quite wrong. He does not assist the gas industry by such reasoning. Atmospheric air is not an inert body, but a necessity of combustion. Without it, gas cannot burn, and without it no heat can be evolved by the use of gas.

It should be obvious to every gas engineer that part of the addition of air to gas may be made in the gasholder; and the mixture so made only requires the further addition of air to bring it up to the best mixture for the incandescent mantle. It is a mere matter of adjustment as to whether or not the whole mixture is made in the bunsen burner. A mixture of gas and air of 300 B.Th.U. per c.ft., prepared from coal gas of 500 B.Th.U. by the simple addition of air, will give the same maximum flame temperature as the original gas, and the same illumination per heat unit. In fact, with ordinary town's gas of 500 B.Th.U. per c.ft., 5 c.ft. of air may be added to 1 c.ft. of gas to make the mixture capable of producing maximum temperature; and if this mixture be burned at suitable pressure in a suitable burner

it will give the highest possible incandescence to a mantle. Such a mixture will have only one-sixth of the calorific value of the gas—that is about 84 B.Th.U. per c.ft. All this could easily have been predicted by any person who had studied the conditions of operation of the incandescent gas-mantle.

In the same way the maximum efficiency could be obtained for heating and boiling water or heating and melting metals. All that is necessary with such a prepared mixture of gas and air is to supply it to a suitable burner at such pressure and velocity as to prevent the flame from striking-back. It is incorrect, however, to reason from instances of such mixtures of gas and air to those of mixtures made with true inerts, such as nitrogen and carbonic acid. The Research Committee of the Institution have exhaustively determined the effect of these inerts; and, broadly, the addition of nitrogen up to 30 p.ct. interferes but little with the value of a gas for producing heat and light. But the addition of carbonic acid becomes rapidly prejudicial after about 10 p.ct. With regard to power, as I have already said, weak producer gas of 130 B.Th.U. and blast-furnace gas of 100 B.Th.U. give high efficiencies in gas-engines with greater ease than rich gases of 500 B.Th.U. and over —such as coal gas, coke-oven gas, and natural gas.

Weak producer gas of about 130 B.Th.U. does not give high enough flame temperature for such an operation as boiler-flue welding. For such high temperatures, either coal gas or water gas is necessary. Producer gas for the same reason is unsuitable for use in evolving light by way of the incandescent gas-mantle. It is here that the fallacy becomes evident of comparing mixtures of gas and air of low calorific value per cubic foot with gases of similar low calorific value due to the presence of true inerts measured before admixture with air. Such low calorific value gases will not incandesce a mantle effectively, while the gas and air mixture will do so.

From this, it follows that producer gas from suction, pressure, or Mond gas plants, is unsuitable for a general service like that of the existing gas industry. Such gases are not capable of giving heat, light, and power in an equally efficient manner. Straight coal gas, however, with any admixture of water gas can readily perform the three duties of heating, lighting, and producing motive power. Accordingly it is to such gas and mixed gases that the engineers of the industry should address themselves.

At the present time, broadly, three methods of gas generation are practised:

(1) Coal gas produced by destructive distillation. Best thermal efficiency of gas generated . . . . . = 62·5 p.ct.

(2) Coal gas produced by destructive distillation, mixed with water gas made from coke in a separate producer. Best thermal efficiency for complete gas produced . . . . . = 67 p.ct.

(3) Coal gas produced by destructive distillation in vertical retorts, combined with steaming of the incandescent carbon. Research-Committee trials at Uddingston. Best thermal efficiency . . . = 62·1 p.ct.

In case (1) 25 p.ct. of the whole heat of the original coal is transferred to the holder as gas; 54 p.ct. remains in the coke; while 6 p.ct. is found in the tar. In case (2) it is assumed that the whole of the coke is converted into water gas in a separate producer, at 70 p.ct. efficiency. In practice, this is not done at present, as the usual addition of water gas to the coal gas does not exceed 50 p.ct. The coke free for sale varies with the proportion of water gas added. In case (3) the best efficiency result of the Uddingston trials was that of Trial No. 4—thermal efficiency of gas production 62·1 p.ct., gas in holder 30 p.ct. of heat of original coal. The gas produced without steaming from the same coal in the same plant in Trial No. 1 was 20 p.ct. of the original heat; and the thermal efficiency of gas production was 54·4 p.ct.

Steaming, when carried further than Trial No. 4, caused a fall in efficiency of gas production. Thus, when 31·2 p.ct. of the original heat appeared in the gasholder, the value fell to 58·6 p.ct. From these trials, it is apparent that the highest gasification efficiencies are not to be obtained by attempting the complete gasification of coal in vertical retorts by steaming and external heating.

In view of these facts, what should be the ideal of the gas industry of the United Kingdom? Broadly, it is plain that for all purposes—especially for motive power and heating—it is necessary that the heat unit should be supplied to the public at the lowest price possible, consistent with financial stability and a reasonable return on the necessary capital. It has long been evident that the field open to the gas industry is capable of very great expansion, provided that gas is supplied at a price per heat unit which will enable the superior advantages and economies of gas in use to balance against the necessarily cheaper heat unit in the form of coal.

In 1917, the gas industry carbonized about 20 million tons of coal. The heat of 10·8 million tons was used to produce and distribute the coal gas utilized in the United Kingdom; while the heat of 9·2 million tons remained available for use in the form of solid coke and semi-liquid tar and oil. At 45 p.ct. thermal efficiency of gas production, the gas generated contained 25 p.ct. of the original heat of the coal, or that given out by completely burning 5 million tons.

If it be possible to generate gas at an efficiency of 80 p.ct. from the whole coal without the production of coke, then the heat of 16 million tons of the 20 millions will be available for distribution. That is to say, dealing with the same total coal as at present carbonized, the gas industry would have a supply for distribution of more than three times the potential heat, light, and power requirements of the country. Could the country absorb this greatly increased supply? In my opinion it could do so with great financial and thermal advantage to the kingdom—both in the sphere of domestic and manufacturing consumption.

The coal used for furnace work of many descriptions in manufactures, together with that consumed for low-temperature heating operations, is not less than 30 million tons; that used in domestic service is about 35 million tons; and that used for motive power on stationary engines is about 45 million tons. So the total field open to the effective competition of the gas industry is about 110 million tons.

The substitution of gas for the present domestic coal consumption would absorb the heat of the whole 16 million tons, with a saving of about 16 million tons per annum on that item only. The consumption of gas for lighting would be increased by a reduction of cost; and motive power distribution by gas-engines might easily increase to 1½ million horse power, instead of the ½ million shown by the census of production. The present consumption for gas lighting is about 3·78 million tons, and for gas-engine motive power about 1·08 millions. By the higher efficiency, nearly double power and light would be obtained from the same fuel. There is undoubtedly ample room for a gas industry with ten times the present output of gas as measured in heat units, provided the cost per 100,000 heat units is sufficiently low.

Those of us who are interested in the internal combustion engine industry have long felt the necessity of low cost per unit of heat, and have been forced by the pressure of steam-engine competition to generate economical gas from anthracite, coke, and non-caking bituminous fuel. Producers of the pressure, suction, and Mond types have been developed to a very useful stage as to reliability, working cost, and thermal efficiency. The highest thermal efficiencies have been obtained with suction producers consuming anthracite; but coke used in such plant also gives high thermal values. Anthracite shows a maximum value of about 90 p.ct., and coke about 80 p.ct. Mond gas, with its ammonia recovery, does not give such high values. A maximum value for such plants is 70 p.ct.; but bituminous fuel gas generators run without ammonia recovery are capable of modification to give over 80 p.ct. At present, no such high efficiencies are obtained. At about 50 p.ct. load-factor, the over-all efficiency is only 50 p.ct. including all stand-by losses.

At what price, then, can the gas industry effectively intervene in the large field still open for the supply of heat, power, and light? Under present conditions of high and fluctuating values, it is difficult to reason clearly. But it is evident, however, that the higher the price of coal per heat unit, the more necessary becomes the competition of gas and the more evident are the money economies resulting from the change.

In the very able and interesting report which has been recently published by the Department of Scientific and Industrial Research, signed by Sir George Beilby, F.R.S., Director of Fuel Research at the Department, there appears the following comparative table showing the cost of 100,000

British thermal units in various fuels at about present prices for coal, gas, kerosene, petrol, and electricity used for heating purposes.

Cost of 100,000 *British Thermal Units in Various Forms* (*Sir George Beilby*).

In good coal at 27s. per ton	100,000 B.Th.U. cost 1d.
,, ,, 54s. ,, ...	,, ,, ,, 2d.
In gas of 500 B.Th.U. per cubic foot at 4s. 2d. per 1000 c.ft.	,, ,, ,, 10d.
In kerosene at 2s. 6d. per gallon . .	,, ,, ,, 19d.
In petrol at 3s. per gallon	,, ,, ,, 25d.
In electricity delivered for heating purposes at 2d. per Board of Trade unit.	,, ,, ,, 58d.

Here the cost of gas of 500 B.Th.U. per cubic foot at 4s. 2d. per 1000 c.ft. is 10d. per 100,000 B.Th.U.; while that of coal at 27s. per ton is only 1d. per 100,000, or a tenth of that of gas. If we assume such fuel cost to be applied to a steam-engine of 8 p.ct. brake thermal efficiency and a gas-engine of 24 p.ct. brake thermal efficiency, then to attain equal fuel cost gas would require to be sold for 3d. per 100,000, instead of 10d. Allowing, however, for the greater cost of running a steam-boiler and engine, as compared with a gas-engine, the coal unit may be rated at 2d. per 100,000 B.Th.U.; and this would correspond to 6d. per 100,000 B.Th.U. That is, when gas exceeded this cost, gas-engine users would adopt gas producers in order to gain an advantage over steam; and in the case of a large power (such as 3000 B.H.P.) a Mond plant would probably be installed with ammonia recovery, and in smaller power with up to about 1000 B.H.P. suction gas plants would be used, consuming either anthracite or coke.

Such plants are now very largely applied throughout the United Kingdom, and are built and installed by many well-known engineering companies. It is difficult to estimate the total power in use; but one firm alone has supplied during the past fifteen years about 3500 suction producers of a total capacity of 275,000 B.H.P. The gas-engines sold during the same period had a total power capacity of about 700,000 B.H.P. So some 40 p.ct. of the output obtained gas from suction producers; while the remaining 60 p.ct. were supplied by town's gas, coke-oven gas, and blast-furnace gas. The total suction producers in use in the country probably exceed 500,000 B.H.P.; and most makers are willing to guarantee a thermal efficiency of gas production of over 80 p.ct.

As bearing on the problem of complete gasification, it is important to consider the efficiencies and cost of gas from Mond bituminous producers in ordinary use. Accordingly, I have obtained the results of three months' operation of a 3000 H.P. plant with ammonia recovery during January, February, and March, 1920. The principal values recorded are: Generated 79·025 million c.ft. of producer gas of 130 B.Th.U. per c.ft., at a total cost of 4·5d. per 100,000 B.Th.U. with ammonia recovery, or 5d. per 100,000 B.Th.U. without ammonia recovery. The fuel cost (total consumed) was 2·6d. per 100,000 B.Th.U. At the power of 1500 B.H.P. while running 47 hours, and 100 to 150 B.H.P. for 30 hours, together with the long stand-by period, the load factor is necessarily low, and the thermal efficiency of gas production also is low—only 54 p.ct. At this rate, the thermal efficiency is lower than that of the best "straight" gas practice, which is 62 p.ct. Notwithstanding, the money cost to the consumer is less. These total costs include the coal used in gas plant and boiler, cost of labour, water, oil, insurance, depreciation, maintenance, and interest on capital. The particulars are given in Appendix A. To compete with this producer gas, at the scale of prices existing in the first quarter of 1920, coal gas would require to be sold at about 2s. per 1000 c.ft., instead of the 4s. 2d. given by Sir George Beilby.

In the pre-war period, coal gas per therm was much lower than this, as may be found in a paper by me read to the North of England Gas Managers' Association in April, 1905. At that time, Widnes was able to supply gas for power at 1s. per 1000 c.ft. of a heating value of 600 B.Th.U., and in several other towns it cost 1s. 6d. per 1000 c.ft. At these prices the cost per therm was 2d. and 3d.—about a fifth to a third of the present cost. Many towns supplied gas for power at that time for 4d. per therm—less than half the present cost. In the paper I compared the small suction producer and coal gas as follows:

> Taking a small suction producer — say, 30 B.H.P. size—operating on the basis of 50 weeks per annum, and 52 hours per week, assuming an average power of 20 B.H.P. throughout the whole time, I estimate the total cost, including interest, depreciation, &c., on the producer plant, the cost of attendance, cost of fuel, and cost of water, at £60 per annum. Now, assuming a coal gas of 600 B.Th.U. calorific value supplied at 1s. 6d. per 1000 c.ft., I find that the cost of 20 B.H.P. for the same term runs out at £74 per annum. This, however, does not include any charge for attendance on the engine supplied with coal gas. It may be taken that, though at 1s. 6d. per 1000 c.ft. there is a small advantage in favour of the producer plant for 20 H.P., yet few small producer plants would be introduced into a town when the gas was sold at this price. At anything over 1s. 6d., however, there is a considerable advantage in suction plant.

The same considerations apply to the conditions of to-day—modified, of course, by the great rise in capital, labour, and fuel costs.

In order that coal gas should compete favourably with the gas producer for a wide range of power, the price per 100,000 B.Th.U. should be about 5d., instead of 10d. At the present time, according to Mr. George Keillor, the Engineer and General Manager of the Greenock Gas-Works, gas is supplied to manufacturers at about 7d. per 100,000 B.Th.U. for gas-engines and industrial processes generally; so that, in the North, the 5d. cost seems nearly attained.

To complete the comparison, I have obtained the results given by a 2000 B.H.P. Mond producer gas plant with ammonia recovery for a period of three months during 1914. The gas generated was 56·55 million c.ft. of 130 B.Th.U., at a total cost of 2·363d. per 1000 c.ft. with recovery—that is, 1·82d. per 100,000 B.Th.U. In 1914, coal gas was supplied to industrial users at 2d., 3d., and 4d. per 100,000 B.Th.U.; so that, at the lower price, it strongly competed with producer gas prices. Full particulars are given in Appendix B.

For power and heating, it is undoubtedly necessary to reduce the cost per therm, in order to obtain the most extended use. But a higher cost is permissible for lighting, as the rival (electricity) costs the consumer 5·8 times that of gas for equal heat, and thus much more than redresses the small thermal advantage of electricity when using the half-watt lamp. A quite favourable charge is 10d. per 100,000 B.Th.U., compared with 2d. per Board of Trade unit for current.

To enable the gas industry to supply gas at a minimum cost per therm delivered to the consumer, it is undoubtedly necessary to allow great liberty to gas engineers to modify existing processes. Fortunately, Sir George Beilby and the Fuel Research Board had this necessity clearly in mind when determining the conditions to be embodied in a Bill to be presented to Parliament by the Board of Trade. Negotiations were entered into; and meetings took place in which representative engineers and chemists from the consumers as well as gas producers were present. As the result of these meetings, eight resolutions were carried, as follows:

First.—That the proposed system of charging the consumer for the potential thermal units supplied to him be accepted.

Second.—That the thermal units chargeable are to be calculated by multiplying the number of cubic feet registered by the consumer's meter by the declared gross calorific value of the gas per cubic foot.

Third.—That the calorific value of the gas is to be continuously measured and recorded by a recording calorimeter of a standard type to be passed by the London Gas Referees. That the method of installing, using, and checking the standard calorimeter is to be prescribed by the London Gas Referees.

Fourth.—That, subject to the acceptance by the gas undertaking of the stipulations laid down in Articles I., II., III., V., VI., and VII., the gas undertaking is to be free to deliver to the consumer any mixture of combustible gases free from sulphuretted hydrogen, and not containing more than:

20 p.ct. of inert constituents for two years.
18 p.ct. of inert constituents for two years thereafter.
15 p.ct. of inert constituents thereafter.

Fifth.—The gas undertaking to declare the calorific value of the gas it intends to deliver, and to undertake to adjust, and if need be to replace gratis, the burners in consumers' appliances, with reasonable speed, so that the gas delivered can be burned in the appliances with safety and efficiency.

Sixth.—Should the gas undertaking desire at any time to change the calorific value of the gas supply, due notice to be given to the consumers or their representatives. During the period of notice, preparations to be made by the gas undertaking for any readjustment of the consumers' appliances which may be required, so that the gas then to be delivered can be burned in these appliances with safety and efficiency.

Seventh.—The gas undertaking, within a period of five years, to supply gas at such pressure that, under normal conditions of supply and equipment, there shall be a pressure of not less than 20-10ths of an inch of water on the gas in any main or service pipe of 2 in. diameter and upwards.

Eighth.—That the unit to be adopted in charging the consumer is to be 100.000 B.Th.U.

These resolutions were, in due course, handed to the Board of Trade.

The then President of the Board of Trade (Sir Auckland Geddes) stated to the House of Commons in November last that he hoped shortly to introduce a Bill giving effect to the recommendations made as above. The preparation of the Bill was delayed; but it has now been submitted to Parliament by Sir Robert Horne, the successor of Sir Auckland Geddes as President of the Board of Trade. The Bill as it stands carries the recommendations of the Fuel Research Board into legal effect; and it affords a large measure of liberty which will enable the gas industry to settle for itself, by the introduction of improved methods of gas production, the exact nature of the modified processes to be employed to supply the public with the gas best suited to produce heat, power, and light at the lowest practicable price, and with the maximum economy of coal—that precious asset on which is built the whole prosperity of the United Kingdom and the British Empire.

The provisions of the Bill are so framed as to allow of even greater changes than were possible under the eight agreed resolutions. The Board of Trade, for example, reserves to itself the right to determine whether any Order is to be made limiting the proportion of inerts present in the gas under consideration; and so it allows each case to be considered on its merits. That this wise precaution is required becomes obvious on considering Mr. Warburton's paper on the chemical composition of pre-war gas, and the relationship of the known facts with the aims of the Fuel Research Board.

The Bill clearly permits a wide range of calorific value, from about 350 to 600 B.Th.U. per cubic foot, and thus allows the manufacture of gas by distillation only, or by complete (or more or less complete) gasification of the coal consumed, as I have already discussed in this address. Under the Bill, it becomes possible for the engineers of the gas industry to adopt methods which are capable of attaining the maximum of thermal efficiency and the minimum of money cost.

The Bill meets the technical requirements of progress, and gives the Board of Trade power to settle the prices to be charged to the public per "therm," which is defined to mean 100,000 British thermal units, at such rates as will recognize the great increase of expenses resulting from the changes due to the war.

Altogether the Bill enables justice to be done to the great gas industry of the United Kingdom. It is obvious, however, that the unlimited use of inerts will not be permitted unless it is proved to the Board of Trade that thermal and financial economy depend on such a chemical composition. It is true that suction producers give high thermal efficiencies in practice. But they generate a gas which is quite unsuitable for general distribution; and Mond bituminous fuel producers as at present constructed do not, in practice, give really high thermal efficiencies, while they also provide unsuitable gas for incandescent lighting and high-temperature work. Apart from these matters, in attempting to increase gas thermal and storage efficiency, the question of distribution must not be forgotten, as appears to be the case when some engineers propose a type of producer gas of the low thermal value of 200 B.Th.U. With gas of about 500 B.Th.U., the distribution charges are nearly equal to the factory charges in the cases of the three Metropolitan Gas Companies; so that any reduction of heating value as drastic as a fall from 500 to 200 would lead to greatly increased distribution costs. However, this is a matter which I need not discuss, as it is doubtless fully evident to all competent gas engineers. A gas of 400 B.Th.U. is very desirable from this point of view.

While on the question of inerts, it is desirable to consider the flame temperatures of gaseous mixtures. Mr. George Helps appears to attach special importance to the presence of a large proportion of inert gases (such as nitrogen and carbonic acid); and he seems to consider flame temperature as practically independent of such dilution. If this be his view, it is clearly incorrect.

It has been long known that large dilution by nitrogen and oxygen (beyond the proportions of the true combustible mixture containing just sufficient oxygen for complete combustion), does not drop the flame temperature very rapidly; but at the same time it is established that flame temperature does fall by such dilution.

My experiments with gaseous explosions—beginning in 1886,* continued in 1900, and corroborated by many observers—prove that flame temperature ranges from 2000° C. to as low as 1000° C. by mere dilution. From this it follows that much heating, melting, and welding work which can be performed by the rich mixture giving 2000° C. cannot be performed at all by the weak mixtures giving the lower temperatures. And so, while the weak mixtures are just as efficient for low-temperature operations (such as boiling water) and also for internal combustion operations, they are not useful for the other high-temperature processes referred to.

Any mixture of water gas and straight gas, both with a small quantity of inerts, does not fall in flame temperature at all, though the heat content per cubic foot may fall as low as 350 B.Th.U. This is due to the high flame-temperature of hydrogen and carbonic oxide. There is no intrinsic virtue in the presence of a large proportion of inerts.

So far I have discussed questions dealing with the generation and distribution of suitable gas; but it is also desirable to consider apparatus and plant constructed to use gas for various purposes.

In order to increase the efficiency of gas utilization, it is necessary seriously to consider the construction and operation of all forms of gas-consuming apparatus, whether intended for the production of heat, motive power, or light. This opens-up large questions of the output and efficiency of metal treating, heating, and melting furnaces, which are receiving close attention at present from able inventors, designers, and manufacturers. Doubtless, the continued work of such men will ultimately develop gas-consuming appliances to a much higher pitch of thermal economy. But it appears desirable for the gas industry to provide some establishment—such as a "Gas Institute"—devoted solely to studying, testing, and reporting on such apparatus. Certificates should be granted to manufacturers and inventors, giving the results of the various tests. This course was followed for many years by the Royal Automobile Club and its predecessor, the Automobile Club of Great Britain and Ireland; and tests have been made and published on motor cars, petrol engines, pneumatic tyres, and all types of motor parts and fittings, from 1899 to the present time.

The spirit of emulation excited among designers and manufacturers has had a most beneficial effect on progress, and materially aided the difficult pre-war development in all types of motor. It showed itself clearly in the wonderfully rapid and perfect creation of the huge motor transport equipment of our armies on the declaration of war. It also assisted in the building-up of the knowledge and experience necessary for the production of the aircraft and the tank engines which helped our armies so effectively.

A "Gas Institute," with a considerable scientific and practical staff, I am convinced would stimulate invention and discovery in gas appliances. The staff could also systematize the collection of data of the gas industry. It is very difficult to present an accurate statement of the operations of the industry in production and use. Data are scattered, and many desirable matters have not been sufficiently tested to enable accurate values to be submitted for consideration.

Our Institution of Gas Engineers has done much good work in this direction, in the initiation of the valuable Research Committees which are now reporting to us. In an industry such as ours, however, much more is required; and an Institute in connection with our Institution and other gas organizations would find ample, useful, and continuous work, which would benefit both sides of the industry if carried out on a sufficient scale, with a large, impartial, and scientific staff. Much good work is being done by the different gas industry organizations and the scientific men (such as Professors Smithells and Cobb) who work with them. H.M. Fuel Research station under Sir George Beilby will be of great assistance to our industry in supplying accurate and impartial tests of all gas production processes; but a "Gas Institute" is also required for the production and valuation of gas-consuming apparatus and the granting of certificates of performances.

* "The Explosion of Homogeneous Gaseous Mixtures." By Dugald Clerk. Inst.C.E.; 1886.

Conclusions.

From the preceding discussion it will be seen that I do not consider gas of the producer type, generated by passing air and steam through incandescent coal or coke, as suitable for the combined services of heating, motive power, and lighting. The possible flame temperature is too low. But apart from this point, no bituminous coal gas producer is at present in existence which can give sufficiently high thermal efficiencies to justify the displacement of the existing three methods. It may be worked out; but the difficulties are great.

In my opinion, the industry will progress by improvements in the distillation method designed to reduce to the lowest possible point the heat required for carbonizing, and adapted to receive a larger proportion of the heat leaving the retort-setting.

Where the heat of the coal is transferred in larger proportion to the gasholder by the use of water-gas plant, it is, in addition, necessary to increase the thermal efficiency of the water-gas plant to at least 70 p.ct. (as has been done at the works of the Gas Light and Coke Company) and dispense altogether with the use of oil. By so doing, it will be possible to get much higher efficiencies of gas generation, either by increasing the proportion of heat of the coal in the holder to 50 p.ct., and selling the coke left, or by completely gasifying the whole of the carbon, and so obtain the maximum possible heat as gas. This may be done by the double process of destructive distillation and water-gas generation carried out in separate appliances; or the two processes may be combined in one apparatus, as is done in the installations set up at Grantham and Normanton.

It is quite certain, however, that the industry is better to avoid immediate revolutionary changes such as complete gasification, except as auxiliary to the main gas process. When sufficient experience has been gained in the new methods, changes can be safely made.

Complete gasification may be desirable in some circumstances; but this will depend on the commercial factors of the sale prices of coke and residuals. So much for gas generation.

On the price at which the therm can be sold to the industrial and domestic consumer will depend the probable limit of expansion of the gas industry.

It is of great importance to the industry to deal with all efficiency-of-use questions by the establishment of the suggested "Gas Institute."

Another matter is also important. Friendly relations should be cultivated between the great industries of gas and electricity. There is ample room and need for both.

In concluding, I would say that I feel it a great honour to have been permitted to participate as your President in the scientific work of the industry at this important and critical stage of your history; at a time when you have been granted some, if not all, the liberty which is desirable from restrictive legislation. I look forward to a very great future of extended utility to the nation for your great industry; and I hope to assist you further in the years to come.

APPENDIX A.

Particulars of Mond Gas Plant at the Works of the National Gas-Engine Company, Ltd.

Estimated Running Cost of 3000 B.H.P. Mond Producer Plant (with Recovery Process) for a Period of Three Months (January, February, and March, 1920).

Coal used in gas plant (Haydock coal)	545 tons.
,, ,, under boiler (Manvers coal)	165 tons.
Cost of Haydock coal per ton	30s. 9d.
,, ,, Manvers ,, ,,	32s. 4d.
Gas obtained per ton of coal gasified	145,000 c.ft.
Total gas generated during the three months	79,025,000 c.ft.

Capital Expenditure.

	£	s.	d.
2000 B.H.P. recovery plant installed 1910	5531	0	0
Allowance for larger boiler installed 1918	600	0	0
Extension of plant to 3000 B.H.P., 1919	4315	0	0
New installation of sulphate house and plant, 1919	3918	0	0
Total capital expenditure	£14,364	0	0

Running Expenses.

	£	s.	d.
Coal used in gas plant (545 tons at 30s. 9d.)	837	18	9
,, ,, under boiler (165 ,, 32s. 4d.)	266	15	0
Labour—			
1 charge hand, £72 17s. 11d.			
3 producer men, £125 19s. 6d.			
3 firemen, £117 8s. 10d.	460	14	7
2 enginemen, £80 1s. 5d.			
2 labourers, £64 6s. 11d.			
Oil—20 gallons, at 4s. per gallon	4	0	0
Water—910,000 gallons, at 3d. per 1000 gallons	11	7	6
Insurance, depreciation, maintenance, and interest (15 p.ct. per annum on capital cost)	538	10	0
Total running expenses	£2119	5	10

Cost of gas when not recovering sulphate of ammonia 6·436d. per 1000 c.ft.

Recovery of Sulphate.

60 lbs. of sulphate can be recovered per ton of coal gasified:

$$\frac{545 \times 60}{2240} = 14\tfrac{1}{2} \text{ tons of sulphate.}$$

	£	s.	d.
Market price of sulphate, £21 10s. per ton.			
14½ tons of sulphate, at £21 10s. per ton	311	15	0
Less 1 ton acid required per ton of sulphate recovered.			
14½ tons of acid, at £6 6s. 10d. per ton = £91 19s. and £1 to be allowed per ton of sulphate to cover cost of packing, &c., £14 10s.	106	9	0
Amount to be deducted from running expenses due to sulphate recovery	205	6	0
Net running expenses for three months, including recovery of sulphate	£1913	19	10

79,025,000 c.ft. of gas generated, at a cost of £1913 19s. 10d. = 5·812d. per 1000 c.ft.

Note re Attached Running Cost of 3000 B.H.P. Mond Gas Plant.

This plant is working under poor conditions, as is shown by the following:

—	Actual per Week.	Possible per Week.
Average load	1500 H.P. for 47 hours.	3000 H.P. for 168 hours.
Light load	100 to 150 H.P. for 30 hours.	
Stand-by period	51 hours.	
Coal gasified	42 tons.	225 tons.
Recovery of sulphate per ton of coal gasified	60 lbs.	75 to 80 lbs. with good running hours.

APPENDIX B.

Particulars of Mond Gas Plant at the Works of the National Gas-Engine Company, Ltd.

Estimated Running Cost of a 2000 B.H.P. Mond Producer-Gas Plant (with Recovery Process) for a Period of Three Months during 1914.

Coal used in gas plant	392 tons.
,, ,, under boiler	156 ,,
Cost of producer coal per ton	12s. 6d.
,, ,, boiler ,, ,, ,,	13s.
Gas obtained per ton of coal gasified	145,000 c.ft.
Total gas generated during three months	56,550,000 c.ft.

Capital Expenditure.

	£	s.	d.
2000 B.H.P. recovery gas plant	5531	0	0

Running Expenses (for Three Months).

	£	s.	d.
Coal used in gas plant (392 tons at 12s. 6d.)	245	0	0
,, ,, under boiler (156 ,, ,, 13s.)	101	8	0
Labour—			
1 charge hand, £42 5s.			
1 producer man, £21 9s.	124	3	0
1 engine and fireman, £21 9s.			
2 labourers, £39			
Oil—20 gallons at 1s. 10d. per gallon	1	16	8
Water—700,000 gallons at 3d. per 1000 gallons	8	15	0
Insurance, depreciation, maintenance, and interest (12½ p.ct. on capital cost)	173	0	0
	654	2	8

Cost of gas when not recovering sulphate of ammonia 2·776d. per 1000 c.ft.

Recovery of Sulphate.

60 lbs. of sulphate can be recovered per ton of coal gasified.

$$\frac{392 \times 60}{2240} = 10\frac{1}{2} \text{ tons of sulphate.}$$

	£ s. d.	£ s. d.
Market price of sulphate, £11 10s. per ton. $10\frac{1}{2}$ lbs. of sulphate at £11 10s. . . .	120 15 0	
Less 1 ton acid required per ton of sulphate recovered. $10\frac{1}{2}$ tons of acid at £1 15s. per ton, £18 7s. 6d.; and 10s. to be allowed per ton of sulphate to cover cost of packing, &c., £5 5s.	23 12 6	
Amount to be deducted from running expenses due to sulphate recovery . . .		97 2 6
Net running expenses for three months, including recovery of sulphate		£557 0 2

Cost of gas when recovering sulphate of ammonia—2·363d. per 1000 c.ft.

NOTE RE ATTACHED RUNNING COST OF 2000 B.H.P. MOND GAS PLANT.

	Actual per Week.	Possible per Week.
Average load	1000 H.P. for 33 hours.	2000 H.P. for 168 hours.
Light load	200 to 250 H.P. for 30 hours.	
Stand-by period.	85 hours.	
Coal gasified.	30 tons.	150 tons.
Recovery of sulphate per ton of coal gasified.	60 lbs.	75 to 80 lbs. with good running hours.

It will be noted that the plant was working with a very low load-factor, and under extremely poor conditions as far as the recovery of sulphate was concerned.

THE NATIONAL GAS COUNCIL AND THE GAS REGULATION BILL.

A General Meeting of the National Gas Council was held last Thursday, at the Central Hall, Westminster, to consider the Gas Regulation Bill.

The chair was taken by the President of the Council, Mr. D. Milne Watson, who briefly outlined the scope of the Bill, and intimated that it would be necessary to endeavour to secure certain amendments when the Bill reached the Committee stage of the House of Commons.

A resolution was unanimously passed cordially supporting the second reading of the Bill.

PERSONAL.

Mr. A. W. GLOVER, the General Manager of Messrs. George Glover & Co., Ltd., of Chelsea, has just been informed by the Belgian Legation that His Majesty the King of the Belgians has been graciously pleased to bestow upon him the "Palmes en Or de l'Ordre de la Couronne," in recognition of services rendered during the war in connection with the organization of hospitality to Belgian war-refugees.

OBITUARY.

The death has lately occurred, at his winter home in Daytona (Fla.), of Mr. ROBERT YOUNG, who was at one time General Manager of the Consolidated Gas Company of Pittsburg. Born in Falkirk, Scotland, in 1840, he early in life became Superintendent of the Alleghany Gas-Works. He was associated with his brother in the firm of J. & R. Young, manufacturers of chemicals, from which business he retired in 1897. The deceased gentleman was uncle to Mr. John Young, of Hull.

Mr. W. H. PEARSON, who died in Canada on April 5, in his 89th year, was for 35 years General Manager of the Consumers' Gas Company of Toronto, with which undertaking he had been associated for over half-a-century. When, 66 years ago, he joined the Company as Chief Clerk, there were only three other members of the office staff; and the output of gas was just under 14 million c.ft. per annum, to 924 consumers. At the time of his retirement in 1909, the Company had 58,513 customers; and the output of gas for the year was more than 2226 million c.ft. Mr. Pearson was one of the founders of the Economical Gas Apparatus Construction Company, Ltd., of Toronto. He, however, never had any connection with the present English Company, formed in 1910.

The funeral took place last Wednesday of Mr. WILLIAM GREEN, who had for the past fifteen years been Manager of the Shirebrook and District Gas Company. He was in his 51st year.

The death has occurred of Alderman JOHN P. ANDREWS, the Manager and Secretary of the Langley Mill and Heanor Gas Company. He was appointed Manager in 1890, having previously been engaged at the Nottingham Gas-Works. Alderman Andrews was sixty years of age. He was a Magistrate for Derbyshire, and had occupied the position of Chairman of the Heanor District Council.

Temporary Increase of Charges Order.—The Ministry of Health have made a second Order, under the Statutory Undertakings (Temporary Increase of Charges) Act, in favour of the Bolton Corporation. The previous Order allowed the Corporation to exceed by one-fourth the maximum price prescribed by their Act of 1872; and the present Order directs that one-half shall be substituted for one-fourth as the amount by which the 1872 maximum price may be exceeded. The Ministry have also received applications for Orders from the Biddulph Urban District Council, the Carnarvon Corporation, and the Oldham Corporation.

ELECTRICITY SUPPLY MEMORANDA.

WE of the gas industry are a bad and crafty lot, and our methods are underhand. Every scientist who investigates the question of thermal efficiency, and finds that the gas industry stands top among the industries in its utilization of coal thermally considered, and has the audacity to tell the world what are his findings, is doing something that is most unworthy. This is what a "Correspondent" of "Electrical Industries" essays to make readers of an article he has written believe. But electrical men are not all deficient in brain power and judgment; so we venture to opine that he will only get the numskulls to pay much heed to what he says. One thing that worries the "Correspondent" is as to who is responsible for the "subtle propaganda in favour of gas heating and power which is being carried on at the present time." There are, he says, gas articles paid for and inspired by the British Commercial Gas Association, which "are of course an essential, legitimate, and quite unmysterious form of general publicity." That is not what disturbs him. It is quite a different thing, and one which he believes it will be difficult to combat. He has noticed, for instance, that the medical correspondent of a highly dignified Sunday newspaper, whenever he touches the subject of ventilation, mentions the labour-saving gas-fire as a most effective way of imparting mobility to the atmosphere of a room. Why he should not do so, if he finds it to be a fact, is not a matter that troubles the "Correspondent." Sufficient for him is the unpardonable sin of referring to the gas-fire at all. The "Correspondent" descends into mere puerility when he writes: "You have only to stand an electric radiator under or near an open chimney, and the heated air will behave in the same pleasing fashion as when under the persuasive influence of the most accomplished de-oxygenator ever recommended by the Gas Light and Coke Company." The electric radiator could not cause the same transfer of air as the gas-fire; and standing it near an open chimney would be fatal to any remnant of reputation it has left as a heater. The heat it imparts is too costly to be used for heating by most people, and for no other purpose by the comparatively few who use it for partial heating. The costliness of the heat is where electricity so completely fails in competition with a form of heating that can afford to part with 20 to 25 p.ct. of the heat generated, and still beat the electric radiator hollow in respect of cost for the heat imparted to a room. What does the incensed one mean by the most accomplished "de-oxygenator" ever recommended by the Gas Light and Coke Company? Perhaps he is one of those foolish persons who believe that gas and coal fires have the capacity for drawing the oxygen from the midst of the other constituents of air, and leave the oxygen-denuded air in the room for human respiration. It is the human being who, and not the gas-fire that, makes use of the oxygen of the air and exhales carbon dioxide into the room.

Incensed.

A Question of Relative Competence.

The writer in "Electrical Industries" sinks to the personal. He finds something very mysterious in the fact that Sir Dugald Clerk has entered so heartily into the coal conservation question, and has personally investigated the matter of relative thermal efficiencies—not only in connection with gas and electricity generation, but in respect of the application of the resultant products. It is alleged by the writer that Sir Dugald "concentrates on the generation aspect of the case, and appears to ignore the possibility that economical generation is not incompatible with inefficient application." This distinctly shows that the writer has not studied what Sir Dugald has really said and written. However, the anonymous "Correspondent" asserts that the frank Sir Dugald, who personally takes full responsibility for his figures, and does not hide his identity in this matter, "exhibits a remarkable lack of intelligence." A man who makes such a statement as this of another of such status in the scientific world as Sir Dugald, and who has not the courage

to divulge his identity, should categorically show just where the "remarkable lack of intelligence" is exhibited. But this man who adopts Sinn Fein tactics and fires from behind a hedge, or covers his face with a mask, contents himself with the inane statement that "it is not necessary to examine his [Sir Dugald's] arguments and figures in detail, in order to show the fallacy of his claim that, on the coal consumption basis, gas secures a more economical utilization of heat and power than electricity." Why not? Perhaps the explanation of the view is found later when we read that "the object of this article is not to refute the arguments of the anonymous [that is good] medical correspondent and Sir Dugald Clerk. Every electrical man can do that for himself." But can "every" electrical man do this? Those who have so far tried have made a horrible mess of their effort! However, it is thought that all this is gas propaganda, and not the result of a studied scientific investigation of the subject. It is believed to be inspired from one source, and that the British Commercial Gas Association. It will no doubt be news to the anonymous writer in "Electrical Industries" to learn that it was the report of the Power Sub-Committee of the Coal Conservation Committee that led the Council of the Institution of Gas Engineers to invite Sir Dugald Clerk, Prof. Arthur Smithells, and Prof. Cobb jointly to investigate, and report to them on, the relative positions of gas and electricity in relation to coal conservation. If the anonymous writer in "Electrical Industries" thinks there is in the brains of these three scientific men, who are experts in fuel matters, a remarkable lack of intelligence and competence to deal with questions relating to thermal efficiencies and fuel economy, then let him show by controverting their findings his own credentials for sitting in judgment upon them. It is easy enough to throw stones and mud; it is not so easy to demonstrate that one is justified in the despicable act.

To Rebut the Verdict of Science.

The anonymous individual also ropes-in Lord Moulton as another "offender;" and he, too," may, in fact, know very little about the practical side of the thermal efficiency question." This is distinctly amusing. His Lordship's scientific training and cerebral acumen count for nought when it comes to (for men with any scientific training) such a simple matter as judging the relative thermal efficiencies of different methods of coal use, and the relative thermal efficiencies of the products in use. Lord Moulton during the war made a very close study indeed of matters of national interest both from the scientific and practical points of view; but electrical short-sightedness is of opinion that he has no right to give the public the benefit of the results of his unbiassed study. What seems to upset the electrical writer is that the ordinary newspaper reader "is bound to believe anything that is said or written by such distinguished people." If the ordinary newspaper reader is not to believe men of such culture and training as Lord Moulton and Sir Dugald Clerk, then who are the public to believe? The anonymous writer of the article on "Insidious Propaganda?" Though he sits in judgment upon Lord Moulton and Sir Dugald, he is evidently not a man who has attained equal distinction in the world. And it seems that his annoyance will only find relief by securing some eminent scientists to do for electricity what is being done for gas. But unfortunately for electricity, and fortunately for the world, scientific men must state facts; and where is the scientific man who has yet come forward and attacked the statements and data to which such names as those we have quoted are attached? The gas industry will welcome any scientist who will endeavour to show that its case is defective, and will be quite prepared to demonstrate to him, step by step and point by point, its complete justification.

Electrical Uneasiness and Bluff.

However, the writer himself indicates that there is no reason to disturb himself, though he does so. The things of which he writes only assist to defer for a time the day when the gas industry will completely depart from this life, and give up its manifold service to the world. This, if really believed, is only the dream of a disordered mind that has not the power to penetrate farther than immediate surroundings. The whole article breathes an uneasiness that does not blend well with the prediction contained in the words: "Even if gas is going to die one of these days (as it undoubtedly will), it is certainly true that the ingenious publicity methods of the 'B.C.G.A.' and its voluntary helpers have had, and will continue to have a delaying action." The gas industry does not yet show many signs of dying; but it does show many signs of large expansion, despite the efforts of electricity in cooking and heating. It was the lament of one electrical engineer not long since that his store-room contained much of the capital expended on cookers and heaters, but in depreciated form. Is it surprising then (most gas undertakings know of these things through the replacing of electric heating and cooking appliances by gas types) that the anonymous correspondent of "Electrical Industries" is in a position to acknowledge that even existing users of electric light will have gas laid-on for heating or cooking or both? He need not disturb himself much over this. Whatever scientific men may say about thermal efficiencies, the experiences of users and their accounts are more effective in business expansion or otherwise in any particular direction; and people are speaking, and the information is going round, of what they have learned by experience in electric cooking and heating. But what is this at the end of the article? We learn there that yet another of our friends—Mrs. Cloudesley Brereton—"seems" to be taking a "sinister interest" in Health Week. This does not look or sound particularly nice; but nevertheless Mrs. Cloudesley Brereton will not be perturbed by the character attributed to the interest that she takes, and took long before her connection with the "B.C.G.A.," in matters pertaining to health.

Results from the New Schemes Wanted.

When the Power Sub-Committee of the Coal Conservation Committee reported, and gave the Government and part of the country to understand that they had discovered the way to the electrical millennium, many people believed that cables and wires would be threaded throughout the country and every little home and every big factory would be receiving electricity at a fraction of a penny per unit. Now all but a few shallow minds know that what was thought to be a serious inquiry and a responsible report gave birth, among other things, to this beautiful piece of deception. Apparently people are still at large who believe that something really wonderful is going to happen in respect of electricity charges. There will be no miracles; and electrical engineers with long visions and deeply-seated thinking faculties know that the days are far hence when prices for electrical energy will generally have reached the pre-war levels. There are limits to most things. There are limits to the economies produced by units of generating plant, and to the effects of such things as the load and diversity factors. Mr. Sugden, M.P., may be one of those who are looking for great things from the development of electrical generation under the Act of last year. Whether he was "pulling the leg" of the Minister of Transport, or whether he was serious in his inquiry, we should not like to be too sure. Anyway, just before the Whitsuntide recess, he asked when Sir Eric Geddes hoped to have a definite economical price fixed for electrical power, and an increased supply at the disposal of industrial undertakings. The reply that Mr. Neal (speaking for the Ministry) gave Mr. Sugden was the only possible one, that there could be no fixed economical price which would be of general application. Then he told him about the initial work the Electricity Commissioners are considering in the nature of schemes for co-operation between local authorities in various districts. However, Mr. Sugden could not get any nearer to definite information as to when prices would be "fixed" under the new schemes. Electricity like everything else will only have its price "fixed" in any one town according to the economic conditions of the times and the circumstances of place and use.

Automatic Regulation of Room Temperatures.

We are not sure that it is a nice or a healthy thing to live in rooms in winter the heating of which is controlled to one temperature. However, some people may like it, and are willing to put up with the consequences. The production of a uniform temperature is stoutly linked-up with the need for economy when using electricity for heating. So Mr. George Wilkinson, of Harrogate, has designed a thermostat control for use with electric radiators. By its means a constant temperature can be assured, and, compared with rooms where the thermostat is not employed, economy can be realized. The "Electrical Times" notices the new device; and it deals with those who raise objection to it on the score of additional cost. To raise objection on such a score is silly, because people who can afford to warm rooms electrically can easily afford to provide themselves with any accessories that appeal to them. In the long run, it is contended, the instrument will save in current such an amount that the first cost will be fully recouped within measurable time; and in these days, of course, the recouping process would go along much quicker than in pre-war days. A figure of one-third saving, we are told, is no mere estimate; it is the testimony of an electrical engineer in a large city. Uniform temperature is the original object of the thermostat; and the economy which takes such an important place in the description is secondary. In our opinion, it should be the primary virtue; the promotion of uniform temperature the secondary one. But perhaps this would be too great a disparagement of the electric heater. The description informs us that the automatic temperature control gear consists of two parts—the thermostat and the circuit-breaker. The former is located in the apartment the heating of which is to be controlled; and the latter is fixed in any convenient place in the building. We go on to read that once installed and set, it will ensure a uniform and comfortable temperature, regardless of the vagaries of the weather. The temperature regulation is very close; and from a temperature chart for a room of 1220 c.ft. capacity in which a heating unit of 2 KW was installed, it is seen (not by us, but by our contemporary) that for a period of eight hours the temperature did not vary more than a single degree Fahrenheit. It would be interesting to know what was the temperature of the outside atmosphere at the time this uniformity was maintained, how long the 2 KW heater was in use before the record was commenced, and what are the means of ventilation in the room?

Waverley Association of Gas Managers.—The annual meeting of this body will be held on Friday of next week, the 11th inst., at the Cockburn Hotel, Edinburgh, under the presidency of Mr. R. Hamilton, of Dalkeith.

THE TAXATION PROPOSALS.

PROPOSED REBATE FOR COKE-FIRED STEAMERS TO PROMOTE BENZOL PRODUCTION.

By E. W. L. Nicol, A.I.E.E., M.I.Mar.E., Engineer and Fuel Expert to the London Coke Committee.

In the flat-rate taxation proposals for both pleasure and commercial motor vehicles, which are based merely on horse-power rating, there appears to be an utter disregard for the admittedly just claim of the commercial motor owner to preferential treatment, and also for the best interests of the motoring fraternity as a whole.

The possible correlation between the impending world-shortage in motor spirit and the present opportunity which the proposed new taxation offers to conserve motor spirit and promote the development of home supplies, does not appear to have been considered. Probably the most important potential home supply is benzol derived from the distillation of coal; but even to the uninitiated it must be evident that the recovery of benzol cannot possibly be the sole primary object of coal distillation. Only about 2 to 3 gallons of refined benzol are recovered per ton of coal treated; and the plant involved in the process of coal carbonization and benzol recovery is enormously costly. In the case of coke-oven recovery plant, metallurgical coke is the primary objective; at gas-works it is gas. The benzol and other secondary products produce revenue which, in the case of gas-works, helps to cheapen the selling price of the gas. The statutory sliding-scale principle of gas charges and dividends payable—the lower the one, the higher the other—automatically provides the necessary stimulus to good and efficient management in the conduct of affairs at gas-works, and therefore the recovery to the fullest practicable extent of all available bye-products.

In the past, one of the limiting factors to carbonizing operations at gas-works has been a serious difficulty in disposing of the surplus coke produced. In order, therefore, to promote the recovery of benzol to the fullest extent, an adequate outlet must be found for all the secondary products which are unavoidable concomitants of profitable coal carbonization and benzol recovery in existing forms of plant.

In the case of the coke-oven, the coke requirements of the iron and steel industries is, in normal circumstances, the principal limiting factor to carbonizing operations. Given an adequate outlet for coke (the bulkiest product of carbonization), gas, and other products, there is practically no limit to the extent to which coal carbonization and benzol recovery can be carried. The fact that the value of a ton of coal carbonized is enhanced by more than 100 p.ct. should be a sufficient incentive to extend carbonizing operations. The case of gas-works is different only in that the gas is the primary product. There is a big potential demand for gas as fuel; but the revenue from the sale of coke is a prime factor in fixing the selling price of the gas (and, therefore, in determining the dividends payable to gas company shareholders). The price of coke, however, is always ruled by that of coal, with which it is necessarily sold in competition. What is required is an adequate and prompt outlet for the surplus coke, in order to avoid the loss due to breakage, and the cost of labour incidental to storing it at gas-works.

Here, then, is an opportunity to encourage not only the production of benzol but its conservation as well, by promoting the use of coke also as a motor fuel. In view of the fact that the proceeds are ear-marked for road improvement and repair, total exemption from taxation cannot be expected; but a substantial rebate on the proposed rates might at least be allowed to coke-fired wagon users. Such a rebate would not add any difficulty to the collection of the tax, and it would entail only a relatively insignificant loss to the estimated revenue—certainly much less than the 50 p.ct. rebate on the petrol tax to which the commercial user was held to be entitled; and it would serve a three-fold purpose. It would tend, by encouraging the manufacture and use of coke-burning wagons, to conserve motor spirit for the lighter transport services; it would tend to provide permanent employment for a larger number of skilled and unskilled workers by promoting the coal carbonizing and benzol recovery and refining industries; and, finally, it would tend materially to improve atmospheric conditions by eliminating the emission of smoke from steam-wagons.

In its present state of development, the coke-fired wagon is probably, without exception, the most economical vehicle for heavy road transport. There are two or three makers who from the outset have designed wagons to develop their full power on coke exclusively; but certain other steam wagons are more or less adaptable to use coke as fuel. Most steam wagons, whether designed for coal or coke, have been proved capable of using either bituminous or anthracitic coal, foundry, furnace, or gas coke; so that, with these alternative fuels available, there can be no question of creating a monopoly. Due largely to the destruction of French and Belgian coal mines, there is at present a temporary shortage of coke, as there is of all forms of fuel; and, owing to the inferior quality of the coal which gas supply authorities are forced to accept, the quality of gas coke is often below normal. With the restoration of the Continental mines to their full output, the temporary shortage may be relieved; and, with a return to normal conditions, there will again be the prospect of a serious coke surplus. Given complete freedom in the selection of their coal supplies, gas companies will naturally prefer coal which for the purpose of gas and coke manufacture has proved to be the best and most economical.

The highest authorities on the subject have pointed out that we must look to alcohol as the motor fuel of the future. But supposing supplies of fuel in this form were immediately available, it would (in engines of existing types) be practically useless unless used in admixture with benzol. Therefore the latter spirit has, and will continue to have, for the motor industry an intrinsic value far beyond its mere fuel value. Its production on an ever-increasing scale should be encouraged by all possible means; and the writer has endeavoured (perhaps not altogether from disinterested motives) to indicate one of the most practical ways in which this desirable object might be accomplished.

Obtaining Money for Extensions.

The following question was put by a staff correspondent of the "Gas Age" to Mr. A. P. Post, the Sales Manager for the American Gas Company, of Philadelphia: "If a prospective consumer comes to the gas company, and asks to have gas-mains extended to his property, and funds are not readily available to cover the cost of making the extension, and cannot be borrowed except at almost prohibitive rates, what is the best thing to do?" Mr. Post's advice was to sell the prospective consumer a bond of the gas company. This, he said, is a good bargain all round. The consumer gets the extension; the company obtain money to finance it; and, what is more to the point, by being a security holder in the company, the consumer not only gets a good return on his investment, but he is directly interested in the success of the company. The present demand for gas services, coupled with the scarcity of money through the regular channels, may be a blessing in disguise for gas companies and public utilities in general. It makes it possible to introduce the idea of customer ownership in specially auspicious circumstances. Progressive public utility companies may well take advantage of the present conditions to advance customer ownership—the safest bulwark against municipal ownership operation and inefficiency. Of course, Mr. Post adds, the extension must be self-supporting. It must be an extension a gas company would make under ordinary conditions. Where the extension is profitable, as most of them are likely to be, prospective consumers are invariably willing to buy bonds, when the situation is explained to them.

Welding a Gas-Main by Oxy-Acetylene.

Prof. Alfred S. Kinsey describes in the pages of the American "Gas Age" the application of the oxy-acetylene process to the welding of a new pipe-line for the Counties Gas and Electric Company—an undertaking managed by the United Gas Improvement Company, of Philadelphia. The line is of 12-in. and 16-in. steel pipe, and is to be used to supply bye-product gas for illumination and heating throughout the territory of Montgomery and Delaware Counties. It crosses the Schuylkill River. The method mostly adopted was welding the joints at the top of the ditch, and turning the pipe to meet the convenience of the welder; this being found the most efficient and economical plan. The pipe was sent with the ends unthreaded and bevelled at 45° for about two-thirds of the thickness of the wall. The bottom of the bevel, however, was so blunt that it proved to be the cause of some poor welds. The welders found it difficult to get the metal melted all the way through. The bevelling was therefore carried right the way down by the cutting-torch, and the bottom of the V was made sharp. Torch-bevelling requires about seven minutes for a 12-in. pipe, and nine minutes for a 16-in. pipe, for each end. After the ends were properly bevelled, the 20-ft. lengths of pipe were aligned, butted closely together, and tack-welded. Then one welder worked at a joint; and as the welding progressed, labourers turned the pipe with chain-tongs, to make the joint readily accessible. About fifteen lengths (300 ft.) of pipe were welded before the section was lowered into the trench. Leakage tests of the joints were made after from ten to fifteen 20-ft. lengths of the pipe had been welded in one continuous run. An air-pressure of 30 lbs. per sq. in. was pumped into the pipe, and the joints brushed over with soapy water. But very few leaks developed. It has been found that the oxy-acetylene pipe-joints cost from 25 to 50 p.ct. less than joints made of threaded pipe-ends and couplings. To this also should be added the reduced cost of maintenance of the joints, and the elimination of loss of pressure common to leaky threaded joints. If the practice is followed of making pipe-welders of trained pipe-fitters, it would seem to go far towards guaranteeing welded pipe-joints of satisfactory efficiency. The welded joint may be made practically as strong as the pipe itself; and it can be rendered as tight and free from leakage due to porousness or edge fusion as any part of the pipe-wall.

Prof. William A. Bone, D.Sc., Ph.D., F.R.S., was unavoidably compelled to postpone until the next session of the Royal Society of Arts the reading of his paper on "Lignite," which had been announced for Friday last.

Arrangements are well advanced for the forthcoming meeting of the British Association, which opens at Cardiff on Aug. 24, when Prof. W. A. Herdman will assume the presidency. The proceedings will include (on Aug. 26) an address to be delivered by Sir Richard T. Glazebrook.

SALARIES AND WAGES IN THE GAS INDUSTRY.

By Thos. Newton.

During the past six years there has been a general transposition of values in many things; but perhaps the most striking incidence is to be found in the relative transposition of values as regards salaries and wages in the gas industry. The betterment of labour was early insisted on, and secured, during the war; and the Government were largely responsible for setting the pace. Phenomenally high wages were paid, oftentimes irrespective of output; and this resulted in higher prices being charged for commodities, which, in turn, meant further increases in wages, and so on until the "vicious circle" was generated. The frantic and familiar competition for labour led to the adoption of a constantly ascending rate of remuneration for all manual workers, both skilled and unskilled. Having once gained a desirable impetus in this direction, labour now seems more disinclined than ever to revert to anything like its former subserviency.

The Salaried Classes.

The salaried classes were largely inarticulate. Certainly they were not organized; and, consequently, through the exercise of an almost unlimited amount of patience, and a generous appreciation of all that is embodied in the highest form of patriotism, they suffered—perhaps too much—in dignified and unprofitable silence. What is true of the salaried classes in this connection is undoubtedly true of the industry generally. It has suffered lamentably as a result of mistaken silence and patriotism.

The positions of the salaried class and the wage-earning class are rapidly becoming more equalized, and in some cases reversed. Instead of being subordinate to the dictates of Capital, Labour is fast assuming the *rôle* of dictator. The salaried classes have lost some of their former prestige. But, more than this, they have lost their relative financial superiority. Indeed, things have come to such a pass to-day that important positions of trust and responsibility are unblushingly offered at a remuneration which, in far too many cases, is below that offered to some road sweepers. Arduous study, technical training, and hard-earned experience are qualifications which, unfortunately, now appear to be very much at a discount. The salaried classes have not only not made any progress, but, in monetary terms of value received for services rendered, they have steadily and surely fallen behind. The struggle for existence among those earning salaries to-day is infinitely keener than among those earning wages.

Progress Made by the Wage-Earning Classes.

The wage-earning classes have made more progress as regards increased rates of pay and decreased hours of labour during the past six years than they made during the last century. They have also ingeniously managed to effect a substantial reduction in their output per hour, which may, or may not, be due to war weariness. Let the cause be what it may, a reduced output per hour is now the rule rather than the exception in most industries. And this, be it noted, is quite a different thing, having a much deeper significance than a reduced output per week as the result of a less number of hours being worked. The workers who come under the heading of the wage-earning classes are under no delusion as to what they want when the cost of living goes up, nor are they handicapped by possessing those finer feelings of consideration as to whether or not the industry can afford to pay what they choose to demand of it. One of the strongest tenets held by the modern trade unionist is that if an industry cannot afford to pay a living wage to those engaged in it, then the sooner it ceases to exist the better. A living wage is interpreted as meaning the wherewithal to secure a standard of life below which a wage-earner will not consent to live.

The Attitude of the Extremist.

All this, of course, is very extreme. Its significance, however, lies in the fact that the industry deals generously, if somewhat reluctantly, with those who take up the attitude of the extremist, while refusing to recognize in an adequate manner the claims of those whose very positions of trust and responsibility make them to some extent tractable, yet whose meagre salaries in a depreciated currency make the struggle for existence very real. The attitude of the extremist cannot be too strongly condemned—neither, for the matter of that, can the attitude of those who are now (surely, if unwittingly) manufacturing extremists. A moment's consideration will reveal the fact that, from a commercial point of view, it is a bad business policy to permit those who hold important and responsible positions in a progressive industry to live in a constant state of chronic financial embarrassment. It requires but little imagination on the part of any fair-minded man to realize what a depressing effect a succession of advances in the rates of pay to the wage-earners has upon a no less industrious salaried official, who gets left behind every time. Contentment, no doubt, is great gain; but it is quite a mistake to suppose there is at the present time anything like contentment in the ranks of the salaried officials of the gas industry.

A short-sighted policy of this description, if persisted in, can only achieve disastrous results. In the first place, it will certainly drive away from the industry many capable and experienced men who would have comparatively little difficulty in finding better remuneration elsewhere. It will also prevent the accession to the industry of the best men available. This, in itself, would be little short of a calamity. Further, it will multiply and intensify the grievances of those who remain behind, when, by a little consideration and fair-mindedness, all sense of injustice could so easily be removed.

The salaried officials in the gas industry have had to bear the brunt of a veritable economic upheaval. Every fresh demand on the part of the workers for higher rates of pay has necessitated more planning and contriving on the part of the officials. The workers are but little concerned in the tabulated results at the end of the financial year. With salaried officials it is far otherwise; and it is largely due to their untiring efforts, unremitting zeal, and devotion to duty, that the industry has so successfully weathered the storm.

Future Prospects.

With an admittedly unlimited future immediately ahead, the gas industry needs men of the highest attainments to develop its potentialities. It is a policy of despair to offer only such attractions as will exclude the best; and the adoption of such a policy would eventually prove suicidal. The stereotyping of mediocrity is the surest forerunner of failure. As yet, the industry has only barely touched the fringe of its commercial possibilities. The progress made hitherto—substantial though it be—is trivial in comparison with what awaits it. The future is largely what the industry likes to make it. But there must remain no rankling sense of injustice—no grievances, real or imaginary, to mar its triumphant progress. Hence, it should first mete-out sympathetic financial consideration to those who for so long have been inadequately remunerated, and then place itself in a position to make what might be called an effective demand on the best intellects. This accomplished, its sphere of usefulness will be still further enlarged; and success in the future will speedily become assured.

Progress of Applied Chemistry.—From Mr. T. F. Burton, B.Sc., the Editor, we have received a copy of Vol. IV. of the "Annual Reports of the Society of Chemical Industry on the Progress of Applied Chemistry." The various sections of these reports (early occasion to review which will be taken) now cover the whole range of subjects dealt with in the Society's "Journal." The price of the volume now under notice is 5s. 6d. to members, and 12s. 6d. to non-members. It has been prepared under the supervision of a Committee which includes Mr. John Gray (the President of the Society), Mr. E. V. Evans (Chairman), Dr. Charles Carpenter, and Mr. W. J. A. Butterfield. The subject of "Plant and Machinery" is dealt with by Dr. W. B. Davidson, F.I.C., Consulting Chemist, of Newcastle-on-Tyne; that of "Fuel," by Dr. J. T. Dunn, Consulting Chemist, Newcastle-on-Tyne; "Gas-Destructive Distillation-Tar Products," by Mr. E. V. Evans, O.B.E., F.I.C., Chief Chemist to the South Metropolitan Gas Company; and "Refractories," by Mr. W. J. Rees, F.I.C., of the Department of Refractory Materials, University of Sheffield.

Peat Resources of Ireland.—The Fuel Research Board of the Department of Scientific and Industrial Research, Nos. 16-18, Old Queen Street, Westminster, have issued in pamphlet form [price 9d. net] a lecture on the "Peat Resources of Ireland," which was given by Prof. Pierce F. Purcell, Assoc.M.Inst.C.E., a few weeks ago before the Royal Dublin Society. In a prefatory note, Sir George Beilby (the Director of Fuel Research) points out that the present revival of interest in peat as a fuel is associated not only with the general scarcity of fuel, but with the great and apparently permanent increase in the cost of coal. Realizing this, the Fuel Research Board have been satisfied that the peat inquiries in which they are interested ought to be based on definite knowledge of the conditions as they exist to-day in this and other countries. These inquiries have reached a stage at which it is desirable that some account of the fundamental facts should be brought within the reach of a wider public; and they therefore welcomed Prof. Purcell's lecture as a clear and fair-minded statement of the present situation, by an expert with intimate knowledge of the subject, who sets forth by illustrations which cannot be misunderstood the problems involved in dealing with a natural material more than nine-tenths of which is water.

A recent communication by M. E. de Loisy to the French Academy of Sciences, has been commented on in the "Daily Telegraph." The writer says that the absorption of ethylene by sulphuric acid is somewhat slow; and a method of more rapid fixation of the ethylene by means of catalysts has been studied by M. Damiens, who, with M. P. Lebeau, had worked-out methods involving catalysis for the analysis of mixtures of hydrocarbons. The catalysts used were vanadic, uranic, tungstic, and molybdic acids in the presence of mercury. It is hoped that catalysts will be available which will render the absorptive powers of sulphuric acid for ethylene comparable with that of potash for carbonic acid gas. Again, instead of regenerating the acid for cyclic use, it is suggested that, alternatively, it should be passed on to the ammonium sulphate plant. Acid for the absorption of ethylene needs to be 66° Bé., while for sulphate plant only 50° Bé. is required. To free the alcohol plant from the cost of sulphuric acid, and to use only the acid of the strength required for sulphate, thus avoiding the cost of separate concentration of 50° up to 66° Bé. acid, it is proposed to effect this concentration by the gas which has been dehydrated in the course of the removal of ethylene. Incoming acid is thus concentrated for ethylene absorption, and after dilution for the recovery of alcohol is passed on to the sulphate plant.

THE PRACTICE AND CONTROL OF OXIDE PURIFICATION.

By Geoffrey Weyman, M.Sc.

[A Paper read at the North of England Gas Managers' Association Auxiliary Meeting, May 29.]

The primary object in oxide purification is to remove hydrogen sulphide from the gas down to the last trace, and the secondary object is to do so as economically as possible.

There are three possible ways available. First, by the formation of ferric sulphide (Fe_2S_3) as the intermediate product, and the subsequent oxidation of this to free sulphur. Under ordinary working conditions, where the purifying area is restricted, the process can only be used in those cases where the oxide employed is true bog ore, or an artificial oxide chiefly made-up of precipitated hydrate. The fact that, as Gedel has shown, the condition must be alkaline, necessitates the use of an alkali to neutralize any acid products formed. Ammonia is the best alkali to employ, as it can be easily distributed and can be supplied in the gas as required. The acid products are continuously generated, and need to be continuously neutralized. Soda is equally effective when properly distributed, and can, like ammonia, be removed when its work is done in solution. Lime is not so good, though cheaper. It is not much use putting it into the new oxide before use, as it merely becomes carbonated by the carbon dioxide of the gas, and is then not available as an alkali. It will not throw the iron out of a ferrous salt when carbonated; but it may be usefully mixed with partially spent oxide, as it then decomposes ammonium salts and releases ammonia, which will again serve as an alkali. The formation of calcium sulphate is objectionable, as it acts as a cement if allowed to dry. Owing to the increasing formation of acid products as the temperature rises, the conditions must be kept well under control, and the development of heat be restricted carefully.

Oxidation, too, must not be carried out at a high temperature, as not only will the amount of alkali required be increased, but the efficiency of the material at low temperatures will be lowered. The best means of limiting the conditions is by the employment of water, and as much should be used as the oxide will carry without being wet. The reason why other oxides than those here mentioned should not be used is simply that they are not sufficiently active at these lower temperatures.

The second process is one which most of us have arrived at for this very reason. In this case, ferrous sulphide (FeS) is the intermediate product derived by the decomposition of the ferric sulphide first formed under acid conditions. Since acid conditions are favourable, higher temperatures may be employed; and, therefore, oxides of other types may be used. Natural ores, other than bog ores, and burnt oxide give good results. The process should not be employed if the purifying area is below 0·5 sq. ft. per 1000 c.ft. per twenty-four hours, and the temperature of the inlet gas cannot be maintained in the winter above 70° Fahr. Alkali is not necessary; and ammonia should be entirely removed from the gas so far as the removal of hydrogen sulphide is concerned. It is most important to note that the oxidation must also be carried out at a higher temperature, or it will be too slow. If this happens, the foul gas gradually spreads through all the boxes, and they will have to be emptied. Atmospheric oxidation will be slower still; and the result is that there is an accumulation of partially spent oxide. When this is again put into a box, it will take some time before heat develops sufficiently for the oxide to become active. Under good conditions, there is no reason why 50 p.ct. of sulphur should not be obtained without more than one removal. But it should be remembered that the oxides used for this process are usually richer in iron oxide and denser than bog ores, and must remove more sulphur per unit of volume than bog ores in order to attain the 50 p.ct. The oxide should be worked as dry as possible, and in any case the oxides, when fresh, will not hold more than 20 to 30 p.ct. of moisture.

The third process, which has not yet been applied to coal-gas purifiers, offers advantages in the fact that most of the sulphur is oxidized direct to sulphuric acid, which combines with the iron of the oxide and may be removed in solution as ferrous sulphate. The process may thereby be rendered more continuous. Special oxide is necessary to secure good results. The temperatures used must be higher, and the conditions more acid.

Success in any of these methods depends upon three factors which are largely dependent on one another—viz.: (1) The material used. (2) The plant available. (3) The temperature which can be maintained. For example, with a cold inlet gas, exposed boxes, and a limited purifying area, the only chance there is depends on the use of bog ore or precipitated hydrate. If the inlet gas never falls below 70° Fahr. and the plant maintains its temperature well, better economy lies in the use of the cheaper oxides.

The question of plant may be considered as follows: First, time must be given for contact. This depends on the velocity of the gas passing through the oxide and on the depth of oxide exposed. The velocity will be determined by the area of any one box with any given material. Apart from the expense of enlarging the plant, there is a limit to the area and depth of oxide. Increase in either direction means spreading out the chemical reactions and the heat they liberate. It means more exposed ironwork to chill the gas; and if the temperature falls too far, condensation of water will occur, and the activity of the oxide will be impaired. The depth is also limited by the extent to which back-pressure will develop. The latter must not exceed the minimum depth of seal at or near the boxes. An idea of the relation between area and temperature will be gained by inspection of the following results:

Experiments on the Relation of Temperature and Velocity of the Purification of Coal Gas.

Temperature of Oxide. Deg. Fahr.	Temperature of Gas. Deg. Fahr.	Time. Secs.	Reaction. Lead Paper.
33	45·5	110	Black.
45	47·5	110	Clean.
33	40	125	Clean.
75	66	65	Clean.
75	66	15	Brown.
32	38	240	Clean.
35	40	90	Dark.
40	45	50	Black.
86	78	35	Clean.

Coal gas containing 10 p.ct. of hydrogen sulphide was passed over the same oxide at different rates; the temperature of the oxide being altered for each trial, in the order given. It will be seen how enormously the time factor must be increased if the temperature is reduced. In practice, 0·3 sq. ft. per 1000 c.ft. of gas per day-area of any one box is sufficient for working burnt oxide if the temperatures are good, but quite impossible if the boxes get cold. Check boxes often give especial trouble in this respect. They usually are only required to remove traces; and obviously the heat gained by reaction is very small. If the gas or the boxes are not warmed in some way, the probability is that they will merely serve as dumps for condensed water.

The number of boxes between which the total depth of oxide has to be divided is a question of convenience in handling. It should not be more than sufficient, owing to the extra cooling surface involved. It should not be less than three, or when one is laid off there will be insufficient depth left to purify the gas.

It has often been suggested that there is a definite maximum velocity above which the gas cannot be purified; but there seems to be no evidence of this. As the temperature of the reaction increases, so may the area be decreased. The final result is presumably expressed in the Claus kiln, where the area and depth of oxide exposed is very small indeed.

The upper limit of temperature for coal-gas purification is imposed merely by the risk of losing control and damaging plant, than by any possible effect on the quality of the gas. The lower limit is certainly fixed by the difficulty of removing hydrogen sulphide. The reactions, of course, liberate very considerable quantities of heat, and the control of the temperatures consists in conserving or dissipating this heat. The first means for doing so is by controlling the temperature of the ingoing gas. This presents great difficulties, particularly on the North-East Coast. With scrubbing plant consisting of tower scrubbers, it is almost impossible. Even though the gas may leave the condensers at 75°Fahr., it may easily drop below 40° Fahr. before reaching the purifiers. Again, in summer the gas may increase substantially by the heat of the sun. In fact, unless the scrubbing plant is housed, it is a matter for serious consideration whether it would not pay to instal a set of water condensers between scrubbers and purifiers through which either the hot water from the usual sets of water condensers, or cold water, as required, might be passed. The cost would in the end work out less than that entailed in using steam for heating coils in the bottom of the boxes and similar means, which cannot be regarded as very efficient. Open steam has been used for the same purpose; but unless it is admitted before the inlet of the boxes, the condensed water may accumulate in the oxide to too great an extent.

The gas is, in normal circumstances, saturated with water at the inlet of the boxes, and will not remove water from the oxide unless the temperature is raised in some way while the gas is passing through the boxes. The cheapest and best way of obtaining this heat is by making use of the heat liberated by the chemical reactions. The bulk of the heat is liberated by the oxidation of the sulphides; and it is this reaction which is most interfered with by an accumulation of water. Besides the water condensed from the gas and that originally present in the oxide, there is the excess of water formed by the sulphiding reactions which must be removed. It is therefore practically impossible to purify cold gas with oxide saturated with water unless external heat is applied. Once the excess of water has been disposed of, the purification may be self-supporting, provided the heat dissipated is not in excess of that supplied by the reactions.

It has been stated that oxidation does not take place in the presence of hydrogen sulphide—only being effected in the clean boxes. While this does sometimes happen, it is merely because the first boxes are waterlogged, and, while the sulphidation may be hindered, oxidation is stopped.

It will easily be imagined that air for oxidation should be warm and dry. The air supplied to the purifiers at the Elswick works of the Newcastle-upon-Tyne and Gateshead Gas Company has recently been preheated by passing through a heat exchanger heated by the exhaust gases from gas-engines. Although the

temperature of the air has not reached the figure we should like, I can safely say that not only can the amount of air so admitted be reduced, but the oxidation proceeds so satisfactorily that the emptying of the boxes may be delayed for a much longer period than has been usual.

From what has already been said, water and steam form very convenient means of limiting temperature, should it rise too high. While the amount of water present should be strictly limited in winter, it is desirable to have more present in summer. Oxide, once allowed to dry-up, will create enormous back-pressure, and present much trouble in its removal. Unfortunately, it is exceedingly difficult to judge the moisture in the oxide while it is in the boxes. The drainage liquor does not provide reliable means of telling this. As a general rule, whenever the temperature is good steam may be admitted with excellent results. Back-pressure troubles are almost obviated by this means. Not only is the fibre kept in a swollen condition, but solids precipitated from the gas—naphthalene, for instance—will come down in a semi-pasty condition, which dries granular instead of in flaky crystals. The setting of calcium sulphate will also be retarded.

Attention has several times been drawn to the fact that sulphur in the purified gas from oxide purification may be very low. The method by which it is eliminated is not known. Possibly it may be in the form of thiocarbonate, but investigation so far has pointed to the conclusion that this explanation is not nearly the whole truth. At any rate, the gas from the Newcastle and Gateshead Company's works has been for months at a time reduced to the neighbourhood of 5 to 10 grains per 100 c.ft. The conditions obtaining during this time were good working purifier temperatures, use of steam, oxide in the boxes slightly acid, and from 1 to 2 grains of ammonia passing into the boxes per 100 c.ft. of gas. Trials conducted where these conditions were altered invariably sent the sulphur figure up to over 30 grains. Ammonia was essential, but above the quantity referred to did not seem to give better results.

The essential data required for the control of purification are a reliable set of temperature readings both of the gas at the inlet and outlet of each set of boxes and of the oxide in each box. The ammonia and tar fog in the inlet gas should also be known, and, of course, the air used for revivification. It has sometimes been the practice to inject the air into the gas before the scrubbers. As tar absorbs oxygen very readily, there will not under such circumstances be much chance of the full amount of oxygen being available for the purifiers.

In addition, it is necessary to periodically determine the hydrogen sulphide at the inlet and at the outlet of each box, or at all events at the outlet of the first two boxes. This will give the indication of when to change a box, as if a box does not absorb 100 grains of hydrogen sulphide per 100 c.ft. when in the first position, it is not doing its duty. The liquid drainage should be examined regularly; and, if ammonia is present to any extent, it may be sent to the liquor wells. The spent oxide analysis should include the determination of ammonia. If found in any quantity, most of it may be removed in the drainage during its last run, and recovered. The oxygen at the inlet and outlet also needs watching.

Finally, I would suggest a costing card for each parcel of oxide—a parcel being the unit of quantity necessary to fill a box. On this card, besides the original analysis of the material, should be noted all the details of its behaviour, and at all events a rough estimate of the cost of labour and materials which has been spent on it. Only with such a system will the purification come on the credit side of the accounts.

Indiana's New Gas Standard.

The Public Service Commission have established a new calorific standard of 570 B.Th.U. per c.ft. of artificial gas in Indiana, as recommended by their Gas Standards Committee last year [see "JOURNAL," Aug. 12, p. 335]. The order permits the quality of gas to vary from this standard to a maximum of 600 B.Th.U., and a minimum of 540 B.Th.U.; but the monthly average must be 570 B.Th.U. If the monthly average is between 560 and 550 B.Th.U., the rate paid by consumers is to be only 98 p.ct. of the regular gas price per 1000 c.ft.; from 550 to 540 B.Th.U., 96 p.ct.; and so on, with a reduction of 2 p.ct. for every corresponding fall in value down to 490 B.Th.U. The consumer is to pay 83 p.ct. of the regular price per 1000 c.ft., if the monthly average calorific value of the gas should be found between 490 and 480 B.Th.U.; from 480 to 470 B.Th.U., 80 p.ct.; from 470 to 460 B.Th.U., 75 p.ct.; from 460 to 450 B.Th.U., 70 p.ct.; from 450 to 440 B.Th.U., 60 p.ct.; from 440 to 430 B.Th.U., 50 p.ct.; from 430 to 420 B.Th.U., 35 p.ct.; from 420 to 410 B.Th.U., 20 p.ct.; and from 410 to 400 B.Th.U., nothing. When the monthly average B.Th.U. is less than the standard, but not low enough to give the consumers a rebate, the company may be required, on approval by the Commission, to pay a penalty to the municipality within whose district the undertaking operates. The Commission recommend the various municipalities to instal an apparatus to enable them to observe the quality of gas, pressure, and such other standards as are required of the company. There are other provisions governing the service. The Commission have fixed the rules in conjunction with the Indiana Municipal League, the Indiana Gas Association, and the National Bureau of Standards; but some of the regulations were not agreed upon by all the co-operating organizations.

ILLUMINATING ENGINEERING SOCIETY.

Report of the Council.

IN their report for the session 1919-20, which was presented at the annual meeting, the Council of the Illuminating Engineering Society stated that the Joint Committee on Railway Lighting have recently received the requisite sanction from the authorities for the carrying out of tests on the chief railways. It is hoped that during the next session a considerable amount of useful work will be done by the Committee. The Committee on Progress in Lamps and Lighting Appliances furnished the Society with a report at the opening of the present session; and it is hoped that similar reports dealing both with gas and electric lighting will be available at the opening meeting next November. The Society have maintained their co-operation with various bodies.

The London "Safety First" Council and the British Industrial "Safety First" Council have been continuing their work, and through their various committees have dealt with problems in which the use of light as an aid to safety is concerned. The latter body have recently issued a pamphlet summarizing the advantages of good lighting in the interests of safety and efficiency; and it is hoped that one section of their activities will be the collection of data on the chief causes of accidents, among which inadequate lighting will receive consideration. A paper on "Industrial Lighting in Relation to Efficiency" was read by Mr. L. Gaster (Hon. Secretary) before the Royal Society of Arts, in the course of which the need for international treatment of this subject was emphasized. Dr. T. M. Legge, H.M. Chief Inspector of Factories, who opened the discussion, stated that he hoped the desired general statutory provision requiring adequate lighting would very shortly be introduced into the Factory Act.

One gratifying sign of the restoration of normal conditions in regard to illuminating engineering has been the recommencement of international co-operation. In the years preceding the war, the Society derived great benefit from the assistance of corresponding members in various parts of the world. During the war this co-operation was unavoidably checked; but during the present session there have been several occasions on which valuable contributions have been received from abroad in connection with discussions. Another feature in the Society's programme has been the regular participation in International Congresses, at which various aspects of illumination were discussed. The forthcoming Congress of the Royal Institute of Public Health, at which the Society will be represented by the Hon. Secretary, will furnish an opportunity of renewing many connections temporarily severed, and recommencing the work that had been initiated before the war on such subjects as industrial lighting—a matter which, it is felt, specially deserves international treatment. The renewal of work by the National Illumination Committee in this country will doubtless prove an indication of the restoration of the International Illumination Commission, which came into existence a few years before the war.

Prof. Strache on "Compound Gas."

According to an abstract appearing in the "Technical Review," Prof. H. Strache, in the "Journal für Gasbeleuchtung," advocates the steaming of retorts when the primary gasification is complete. The resultant mixture he terms "compound gas," and says it has a calorific value of 374 B.Th.U. per c.ft., compared with 615 B.Th.U. for ordinary gas from the same coal. The quantity of compound gas produced per ton of coal is 56,500 c.ft., and that from coal gas only 11,650 c.ft.; while the total calorific values are 21,100,000 B.Th.U., and 16,800,000 B.Th.U. respectively, including an allowance for coke in the latter case. There is consequently a saving of 20 p.ct.; and it has been shown that compound gas and incandescent burners yield a light which compares favourably with that obtained from coal gas, provided the gas and air supply are suitably adjusted. It is equally satisfactory for cooking and heating, and does not affect the yield of bye-products. Allowing for the heat used in producing steam and heating the retorts, the author gives the following heat-balance:

	Per Cent.
Minimum calorific value of gas produced	60·2
" " " tar "	8·3
Total useful effect from the coal	68·5

Gas-works on the above principle are in operation in the Austrian town of Graz; and the following features are claimed: Reduced floor space; the apparatus always ready for use; less labour; and comparatively low first cost. To which must be added several advantages non-existing where water gas is produced separately and mixed with coal gas—coal is used instead of coke, greater calorific value of the gas, and a higher proportion of bye-products. The tar produced in Graz is of excellent quality; the yield being as high as 162·5 lbs. per ton—80 p.ct. of the theoretical quantity possible.

Meter Reading by Photograph.—The gas-meters in New York City are to be read by photograph. Meter-readers employed by the gas company will be equipped with small cameras which fit over the indicator on the meter. By pressing a button, light is thrown on the dial and exposure made, showing the amount of gas consumed since the last photograph.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gas Companies and the Supply of Hot-Water Fittings.

SIR,—The obtaining of statutory powers to enable gas undertakings to control the sizes of supply-pipes in houses, and the adoption of a standard specification and a voice in installation methods, are measures which appear to be very necessary, and in their application will do something to relieve gas undertakings of complaints arising from causes which at present are beyond their control, and the remedy of which is a costly business. With companies who run their own commercial or sales department, the troubles arising from causes such as this are not so apparent; and many architects and builders with whom close touch is maintained are willing to adopt suggestions as to piping, &c., where they undertake their own carcassing, though in most cases the gas undertaking satisfactorily carries out the work. The need for the powers suggested is, however, very real; and while such matters are under consideration, might it not also be wise to take up the question of hot-water circulating systems? The installation of the gas-heated boiler, either in lieu of or as an adjunct to the range-circulating system, is becoming common, and is bound to be increasingly popular. In many instances, the existing systems are found to be either defective or wrongly designed, and quite unsuitable (without alteration) for use with a gas-boiler, and accordingly have to be brought up to date to produce a satisfactory gas-heated hot-water supply.

It may, of course, be argued that the design of each system is regulated to some extent by the size of the house, the number of points to be supplied, &c.; and I quite agree that no hard-and-fast rule can be made to operate successfully as a general requirement. But I hold that all proposed hot-water installations should follow certain principles, and be submitted before installation and approved by either the local authority or some other competent body.

It might also be desirable to suggest the inclusion of T-pieces in the flow-and-return pipes where exposed, so that the cost to the consumer on the installation of a gas-heated boiler would be very considerably reduced.

Something might be done to bring pressure to bear on local authorities, with a view to inducing them to insist on the inclusion on plans of the hot-water systems in all applications for new buildings operating after the manner of drainage and sewage requirements. Anyhow, the matter is worthy of attention, having regard to its influence on the future of gas-heated hot-water supply.

SAML. B. CHANDLER.

South Suburban Gas Company,
May 22, 1920.

The "Therm."

SIR,—Having just read a copy of the Gas Regulation Bill, I write to ask if it would not be better, and of more value to our industry, if 50,000 British thermal units be taken as a "therm," instead of 100,000 B.Th.U., as stated in clause 1, part 2? This would make the price charged per therm work out (at the prices per 1000 c.ft. at present charged in the industry) from, say, 4d. to 7d. This would reasonably compare with the present charge per unit of electricity.

H. C. HANDLEY, Engineer and Manager,
DENTON U.D.C. GAS-WORKS.

Denton, May 22, 1920.

Oxide Purification.

SIR,—I think the letter from Dr. G. W. Anderson in your last issue brings our opinions into much the same line, except for one or two more or less theoretical issues.

I would not, however, regard the iron sulphide which is ordinarily used for laboratory purposes as being composed of ferrous sulphide, FeS, to any extent. It appears to consist largely of the sulphides of the general formula Fe_nS_{n+1} which oxidize in the presence of water to sulphate. In this connection Gedel's work is particularly interesting.

GEOFFREY WEYMAN.

Newcastle-on-Tyne, May 28, 1920.

Fraserburgh Gas-Works Extension.—The question of the extension of the gas-works has been remitted to the Fraserburgh Gas Committee for a report. A proposal is made to purchase a gasholder of 250,000 c.ft. capacity, and a carburetted hydrogen plant.

Drogheda Gas Price.—The Drogheda Corporation have adopted a recommendation of the Gas Committee that application be made to the Local Government Board for Ireland for sanction to increase the price of gas from 7s. to 10s. per 1000 c.ft., on the ground that wages and coal costs have gone up, and that expensive repairs are needed at the works. The Mayor (Alderman Monahan) said a full increase might not be imposed at once; but at a critical time like the present, they should have power to act without waiting for sanction.

Gas Department Overdraft at Yeovil.—While holding a local inquiry into an application by the Yeovil Corporation for sanction to borrow £4275 for further plant at the gas-works, Mr. H. R. Hooper, of the Ministry of Health, criticized those responsible for permitting overdrafts to accumulate year after year until they reached £4800; and he adjourned the application to enable steps to be taken to wipe it off. He remarked that the Council had no powers for creating an overdraft of this description; and it would have to be met before anything further was done. He hoped to hear something definite from the Council as to what they intended to do in the matter. Mr. G. H. Gould (Chairman of the Gas Committee) said the loan was required to instal plant for increasing the output of gas. The Inspector pointed out that the retort-house was old; and the gas-works generally had to be put in better condition.

REGISTER OF PATENTS.

Gasification of Carboniferous Substances.

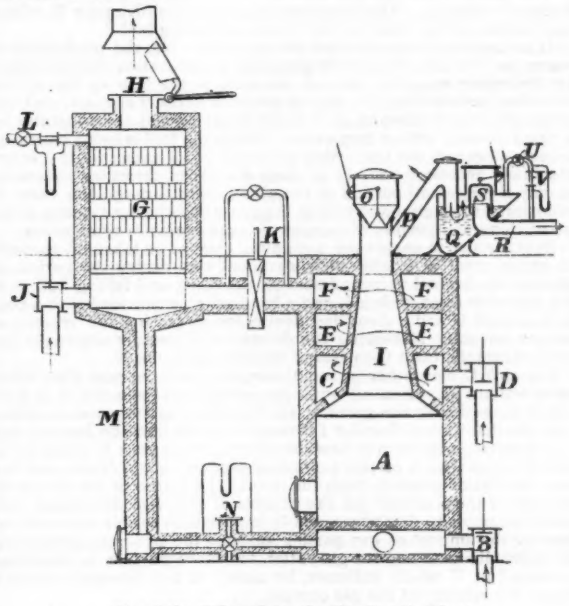
No. 117,083.

STRACHE, H., of Vienna.

No. 10,352: June 22, 1918. Convention date, June 28, 1916.

This process relates to the complete gasification of bituminous fuels in generators where hot blast and steam are alternately supplied, and in which the distillation chamber or retort is in direct communication with the gasification chamber or generator without the interposition of any cut-off device, and in which, in known manner, the distilled gases produced during the period of blowing-up the fuel to incandescence are utilized in various ways—for instance, "by storing the distilled gas in a suitable storage chamber."

In processes hitherto based on this principle, steam was continuously blown in, producing the gas at the lower portion only of the generator, and the distillation ("degasification") of the bituminous fuel carried out partly by the heating from outside by means of the producer gas generated, when the fuel was blown-up to incandescence, and partly by the heating from inside by the hot ascending water gas. But according to the present invention, the distillation during the process of gasification is materially promoted by blowing steam into the generator at a place where the distillation chamber or retort and the gasification chamber or generator join one another. This will also materially promote the formation of ammonia. The steam may also be used in a superheated state; and for this purpose it is allowed to flow through the heating flues surrounding the retorts. This also prevents the collection of incombustible gases in the flues during the process of gasification; and for the further increase of its temperature a separate steam superheater, heated by the waste gases produced when the fuel is blown-up to incandescence, may be employed. In this case a large volume of steam in a slightly superheated state may be employed, and thereby a higher yield of ammonia obtained. The temperature of the steam must, however, be below 800° C.—the decomposition temperature of the ammonia.



Strache's "Complete Gasification" Plant.

In this way it is also possible to effect the distillation of the fuel by superheated steam alone, which is, says the patentee, introduced at the place where the distillation chamber or retort and the gasification chamber or generator join one another, so that in this case it is not necessary to pass the water gas formed in the lower part of the generator through the fresh fuel. It is taken-off at the lower part of the generator, and the supply of steam from below is dispensed with.

In consequence of the utilization of steam having a temperature under 800° C., distillation gas containing a high percentage of ammonia is produced in the distillation chamber or retort and led away at the top; while the steam simultaneously passes through the column of coke in the generator from top to bottom and forms water gas, which is led away below. The two gases may then be purified in the usual way, separately from each other, and used separately or mixed in any desired manner.

The purification of the gases separately has also the advantage, when the mixed gas is produced, that the apparatus for removing the tar and the ammonia may be considerably smaller than when the whole of the gas mixture, which occupies a much larger volume, has to be freed therefrom.

If it be desired to pass only a portion of the water gas through the retort in order to promote the distillation of the fuel, the steam intended for the generation of the water gas is passed in at a lower point—say, at about the middle of the generator—so that a portion of it passes downwards and forms water gas, which is taken-off at the bottom, while another portion passes through the upper part only of the generator, and then flows through the retort in the form of water gas.

When the fuel is being blown-up to incandescence, the retort is heated by the producer gas formed in the generator by the aid of a secondary air-current, by means of the hot gases in the heating flues

playing around the wall of the retort. Distillation gas is thereby produced from the fresh fuel and must be led away, during the period of blowing the fuel up to incandescence, from the upper part of the retort in the proportion in which it is formed. For keeping the temperature in the distillation chamber lower than usual, only a small portion of air is blown into the heating flues surrounding the retort, for burning the producer gas escaping from the generator into the flues; while another portion of air is supplied to the still unburnt gas before it reaches the steam superheater, so as to effect complete combustion.

To carry out the process (and its various modifications) the apparatus illustrated in vertical section is employed. A is the gasification chamber or generator, heated by a hot blast supplied from underneath by a valve B. The producer gas escapes through slots in the heating flue C, where it is burned with air supplied at the top through the valve D, so that the flame gases sweep through the heating flues E F, and then pass into the steam superheater G. The waste gases escape through the opened waste-gas valve H into the chimney.

In cases where, for the purpose of obtaining a higher yield of ammonia, the temperature in the distillation chamber or retort I is to be lower than usual, only a portion of the top air is blown in through the valve D, the remainder entering through the valve J into the steam superheater and effecting complete combustion of the producer gas.

Between the heating flues F and the steam superheater G is placed a cut-off device K, which is opened while the fuel is being blown-up to incandescence, but not tightly shut-off even when closed.

The gas is produced by the admission of steam at L into the steam superheater after the shutting-off of the air supply at B, D, and J, and after the shutting off of the waste-gas valve H. In the superheater the steam is heated up on the fire-clay bricks built into it, and a portion of the superheated steam now passes through the pipe M and the steam throttling device N into the lower part of the generator. Another portion of the steam passes out of the superheater G, owing to the never quite avoidable leakiness of the valve K, also through the bye-pass into the heating flues F, E, and C, and then into the distillation chamber or retort I, where it mixes with the water gas formed in the generator in consequence of the steam admitted at N; and both the water gas and the portion of the steam effect the gasification of the fresh fuel intermittently supplied through the charging hopper O.

The gas mixture escapes through the ascension pipe P into the hydraulic main Q. This latter contains the gas outlet pipe R, which can be shut-off by means of the rising and falling bell S.

If no steam is to be admitted at the bottom, but the production of water gas is to take place in the generator or gasification chamber solely by the steam entering through the slots in the heating flue C, the throttling device N for the bottom steam is entirely shut-off, and the water gas is then taken off at T in the lower part of the generator by a pipe furnished with a stop-valve. While the fuel is being blown-up to incandescence, the stop-valve is closed for all cases, while it is not absolutely necessary entirely to close the steam throttling device N, as only a very small portion of the air supplied through the valve B will escape through it and pass to the steam superheater G; and in the latter, this small portion of escaped air even promotes combustion.

In order also to enable the distillation gases to be taken off through an outlet point of smaller cross-sectional area during the period of blowing-up the fuel to incandescence, the rising and falling bell S in the hydraulic main is closed, and a bye-pass pipe provided with a controlling cock U and a throttling device for measuring the velocity of the gas current. Measuring the difference of pressure allows the gas in the hydraulic main Q to escape into the gas outlet R.

The cock U may either be so adjusted that only the pure distillation gases without admixture of water gas escape into the outlet R (a portion of these distillation gases, if the throttling be too great, escaping from the distillation chamber I through the slits into the heating flue C, and serving with them to heat the retorts), or the cock U is opened to such an extent that a certain amount of producer gas is drawn with the pure distillation gases through the retort. By means of the high temperature of the producer gas the process of complete distillation will thus be promoted. It is consequently important to be able constantly to measure the amount of gas passing through the bye-pass connecting the hydraulic main and the gas outlet, for which purpose a throttling is effected at V which indicates, by means of a differential pressure gauge, the velocity of the gas current.

Coke-Quenching Devices.—No. 133,239.

HEELEY, G., of Paris. No. 2013; Jan. 27, 1919.

This device for quenching coke is more particularly suitable for dealing with large amounts of incandescent coke, such as are produced in coke-ovens, furnaces for the manufacture of lighting gas, or any other systems. The object aimed at is to provide apparatus, easy to manipulate, and at the same time ensuring "complete and uniform quenching in a minimum of time." Another object of the invention is to ensure the rapid removal of the coke and coke dust, and afterwards to separate the dust from the coke.

The apparatus comprises metal framework to support all the apparatus—such as winches, motors, gear wheels, gears, &c.—required for the various operations, as well as for resisting any shock due to the fall of coke. In large installations, this framework is mounted on rollers so that it can be brought in front of all the ovens in operation. The coke is received by a double-walled receptacle, the inner wall of which is perforated so that the water used in the quenching, as well as the coke dust, may pass out. The water is projected under pressure on to the incandescent coke, and thence through the coke, collecting (with part of the coke dust) at the bottom part of the receptacle, between perforated and solid walls. The receptacle is pivoted and can be raised by chains passing over a winch. As soon as the lip of the receptacle passes beyond the horizontal position, the quenching water escapes from between the two walls of the receptacle and is discharged with the coke dust into a channel provided for the purpose. When the receptacle arrives at its highest position, the door is automatically opened by an arm secured to the receptacle; and this allows the coke to fall out. It can drop either into a skip arranged for subsequent manipulation, or direct into trucks. When the receptacle has been discharged into the skip, a tractor truck carries the skip under the jib of a crane constructed so that it can discharge the coke either into reinforced concrete silos or directly into trucks travelling on a rail track. The coke having been discharged, the crane replaces the skip on the tractor truck for a fresh operation.

The quenching water and the coke dust are conveyed through a channel into a skip, the walls of which are constructed so as to form a filter that allows the water to pass into a pit and yet keeps back the coke dust. When the skip is full of coke dust, it is removed by the crane and discharged into a silo provided for the purpose or into a truck. The emptying of the skips is controlled automatically from the cabin of the crane by means of cables, chains, and pivoted levers which tip one skip and open the bottom of the other one. When the latter is empty, it is brought back to the pit for the following operations.

Incandescent Gas Lighting.—No. 141,623.

MILLSOM, H. W., of South Hackney, E.

No. 25,914; Oct. 22, 1919.

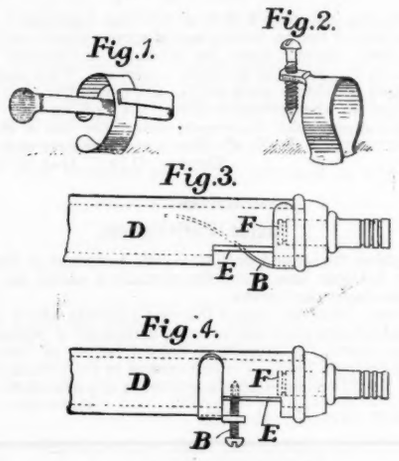
The device according to this invention comprises a combination of a piece of refractory mesh, a pair of hinged frames adapted to hold (but not to grip) the mesh, and a metal holder connected at one end to the hinged frames and adapted at the other end to be fitted on to the burner. Means are provided whereby the angle of inclination of the mesh-carrying device in relation to the burner may be adjusted as required to give the best lighting effect in the preferred direction. According to a further feature of the invention, the mesh-carrying device is so shaped as to be convex towards the burner; so that the mesh assumes a convex form when in position. As a result of this construction, the pressure of gas merely tends to cause the mesh to assume a flat surface, whereas with previous constructions of a like kind the pressure of the gas causes the mesh to bulge outwards, so that it becomes strained and liable to break.

Atmospheric Gas-Burners.—No. 142,159.

HELPS, GEORGE, of Nuneaton.

No. 19,503; Nov. 27, 1918.

This invention relates to means by which the supply of primary air may be adjusted in cooker and gas-fire burners—viz., by an obstructing strip or tongue attached to, or forming part of, a clip on the burner tube. When a plug or screw is employed, the member with which the plug engages is attached to, or forms part of, the clip. Fig. 1 shows (in perspective) a clip to which a tongue is attached, and fig. 2 a similar view of a clip with screw. Fig. 3 shows a burner to which a clip somewhat similar to fig. 1 is attached. Fig. 4 shows a burner to which the clip in fig. 2 is attached.



Helps's Atmospheric Burner Clip.

The tongue or strip B has an increased area at the end. As a parallel strip it is so made that it can be bent to obstruct the full-way of a burner tube to any desired extent. In figs. 3 and 4, the burner tube D has its air inlet at E, while F is the nipple. In the combination shown in fig. 3, the regulation of the air is effected by sliding the clip on the burner.

Photometers, Actinometers, &c.—No. 141,825.

HARGREAVES, F. J., of Coulsdon, Surrey.

No. 2094; Jan. 28, 1919. No. 18,483; July 25, 1919.

This combined invention relates to photometers, actinometers, &c., of the kind in which a visual comparison is made between the source of light or illuminated surface to be measured, and a standard source of light of constant or approximately constant intensity.

Hitherto this standard source of light has usually consisted of a flame, such as a standard candle, or of a specially adjusted lamp burning liquid or gaseous fuel of definite composition. According to the present invention, however, the standard consists of a radio-active substance associated with a substance (such as zinc sulphide) which emits light under the action of the radiations from the radio-active substance.

Preferably the standard comprises two normally separate elements, one carrying the radio-active material, and the other a light-emitting

material; and means are provided for moving the two elements into close proximity when required.

When a very bright standard is not required, ordinary radio-active luminous paint may be used, provided the paint has reached a steady state of luminosity. When absolute constancy is not essential—as, for instance, in a photometer used for comparative measurements only—luminous paint may be used while its luminosity is still diminishing, owing to the destructive effect of the α particles on the zinc sulphide.

The standard is preferably arranged as an opaque area on a translucent screen to which the light to be measured is admitted, and means are provided for varying the amount of light falling on the screen.

For the measurement of X-rays it has been proposed to compare the fluorescence excited on a fluorescent screen by the rays with that excited on the same screen by radiation from radium. This invention, however, is concerned only with the measurement of visible light.

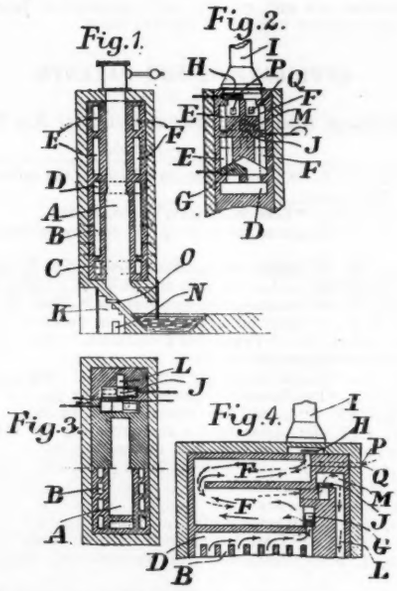
Gasification of Carbonaceous Material, Oil-Shales, &c.

No. 142,163.

CHRISTOPHER, J. E., of Maryport.

No. 21,724; Dec. 30, 1918.

This apparatus comprises a retort or chamber adapted to be heated by gas admitted together with air (if necessary) into a main external heating flue surrounding the retort. Two auxiliary chambers are arranged in connection with the main flue, to receive the products of combustion and thus further to heat the retort. The heated products of combustion pass entirely through one or other of the auxiliary chambers, giving up a portion of their heat, and pass finally into a chimney stack. During the period in which one auxiliary chamber is being heated, steam may be admitted into the upper end of the other chamber, and passes down into a distributing chamber and thence into the retort—becoming superheated in its passage. The flow of the products of combustion and the steam is changed periodically by dampers or the like. Fig. 1 is a sectional elevation of one form of the retort constructed. Fig. 2 is a part section through the dampers. Fig. 3 is a sectional plan. Fig. 4 is a sectional side elevation of the top of the retort, showing the passage of the products of combustion and also of the steam in one of the auxiliary chambers.



Christopher's Coal Gasification Plant.

The lower portion of the retort A is heated by any suitable gas, admitted (with air if necessary) into a main external heating flue B at C. The products of combustion unite in a horizontal flue D, and pass upwards into one or other of the auxiliary regenerative chambers E or F according to the position of the dampers G and H. The heated products of combustion thus pass entirely through one or other auxiliary section, giving up a portion of their heat and finally emerging into a chimney stack I, "after a substantial reduction in temperature." During the period in which one section is being heated, steam, admitted at the upper end of the remaining section, becomes superheated by contact with the previously heated walls, and passes, by reason of the position of the damper J, through the port M into a vertical channel L, and issues from a port N into a distributing chamber K—entering the retort itself through the passages O, and thereby acting as a means of transferring heat from the products of combustion of the gases in the flues B to the contents of the retort itself.

In fig. 4 the passage of the products of combustion is indicated by full-line arrows; the passage of the steam, by dotted-line arrows.

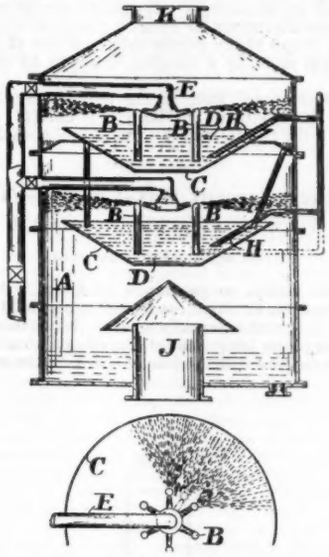
The flow of the waste gases and of the steam is changed periodically by the dampers G, H, and J and a two-way cock for the steam. The dampers are operated by rods, or the like, so that G and H move simultaneously and in the same direction; the damper J being simultaneously moved in the opposite direction. A two-way cock is also arranged to be simultaneously operated to admit steam through the port P when the damper J is moved to the right in the position shown and through the port Q when J is moved to the left.

Washing Gas.—No. 142,203.

HACK, T. H., and BOUGHTON, H. F., of Birmingham.

No. 2825; Feb. 5, 1919.

This invention relates to an apparatus for producing a spray for washing coal gas, the object being to use gas under compression, in such a way that "a near approach to or a complete annular spray or fog is produced with less pressure of fluid than hitherto."



Hack and Boughton's Spray for Gas-Washers.

A sectional elevation is given of the plant applied as a machine for washing gas; also a plan of the spray device.

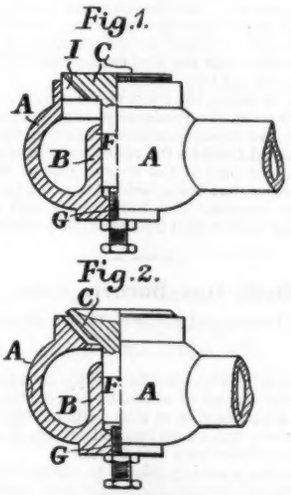
Within the receptacle A is arranged any number of tubes B, disposed in circular formation in plan and vertical in elevation. The open bottom of each tube extends into liquor D contained in a tray C; and each tube has an open mouth or nozzle at the top. Where the tubes, however, receive liquor direct from a supply pipe like that shown by broken lines, their bottom ends are closed. In the middle of the circle of tubes, and concentric therewith, there is a tube E from which extend radially nozzles each pointing towards the mouth of its respective tube B, and in the same vertical plane. Clean or unwashed (compressed) gas is conducted to the nozzles and blows therefrom freely across the mouths of the tubes, causing the liquor to be blown away in the form of spray or fog. The sprays are arranged to intervene as shown in the plan, and in circles one above the other in the elevation. They thus form in combination "a very near approach to a complete annular spray." The liquor is supplied to the trays by the pipes H, or direct to the tubes B by pipes shown in broken lines. The compressed gas is supplied to the nozzles by pipes E communicating with a supply pipe common to both. The inlet to the washer may be at J, and the outlet at K, or they may be reversed or applied at any other position.

Bunsen Burners.—No. 142,222.

HELPS, GEORGE, of Nuneaton.

No. 4167; Feb. 19, 1919.

This invention is an improvement in the bunsen burners described in patent No. 1023 of 1917—the burner here being provided with a deep



Helps's Bunsen Burner.

internal socket in which the stem of the head so engages that the head remains true in all positions, while means are provided for acting on the stem for raising and lowering the head.

Fig. 1 has a body A, an internal socket B, and a movable head C provided with tapering sawcuts or passages I. The head is provided with a stem F resting upon an adjusting screw G. The regulation of the orifices is effected by the entry of the head C into the body A.

This type of burner, says the patentee, besides being useful for heating purposes is also useful as an upright or inverted incandescent lighting burner "when modified in ways obvious to gas engineers." A bunsen burner producing coneless flames capable of a large amount of regulation is of great utility in incandescent lighting, as a head of the same size can be used for obtaining a large candle power or a small candle power—the main alterations for obtaining large or small candle power residing in the length of the burner tube and that of the mantle; the large adjustment allowing a coneless flame to be obtained in both cases.

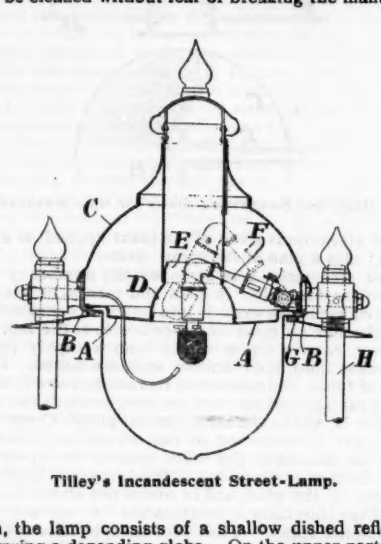
Fig. 2 is an improved form of the burner described in the 1917 patent. Here the mouth of the body A is conical, while the coned head forms with the conical mouth a passage of considerable length.

Inverted Incandescent Gas-Lamps.—No. 142,249.

TILLEY, F. C., of Kingsland Road, E.

No. 6983; March 20, 1919.

This invention relates to gas-lamps for street lighting employing incandescent mantles, in which the burner is provided with upwardly swinging pipes actuated externally so that the burner can be raised from the outside of the lamp clear of the reflector to allow the reflector and globe to be cleaned without fear of breaking the mantle.



Tilley's Incandescent Street-Lamp.

As shown, the lamp consists of a shallow dished reflector A in a frame B carrying a depending globe. On the upper part of the frame is a canopy C within which is a chimney. The air to support combustion enters at the lower edge of the canopy or through a hole in the globe, while the products of combustion pass away by the chimney. The canopy may be either hinged or fixed to the frame. The chimney is in two parts—one D positioned just over the hole in the reflector and of a size to allow of the burner and mantle being moved therein; while its upper part is contracted and provided with guide prongs at its upper edge—a slot also being formed for the movement of the burner and mixing tube F.

To the frame B is secured a short length of tube G, one portion of which is positioned outside the frame for connection to the gas supply-pipe connection H, and the other portion (inside the frame) carries a plug casing with gas-tap. On the plug end carrying the burner and mixing chamber F is a hollow arm projecting towards the edge of the frame, in which a slot is formed for the insertion of a key whereby the burner can be moved about the plug casing and lifted into the chimney or lowered for proper lighting.

While the lamp is alight, the chimneys fit together somewhat tightly so as to ensure that all the products of combustion will pass up the chimney, while the air to support combustion is directed to the flame. But when it is desired to clean the reflector and globe, it is only necessary to lift the upper part of the chimney so as to free it from the lower part—the upper part being held in position by gripping the edge of the hole in the canopy. The burner plug and its casing make a tight fit, so that the burner will be held at the placed position by the grip.

Atmospheric Gas-Burners.—No. 142,401.

YATES, H. JAMES, and ADNITT, W. D., of Birmingham.

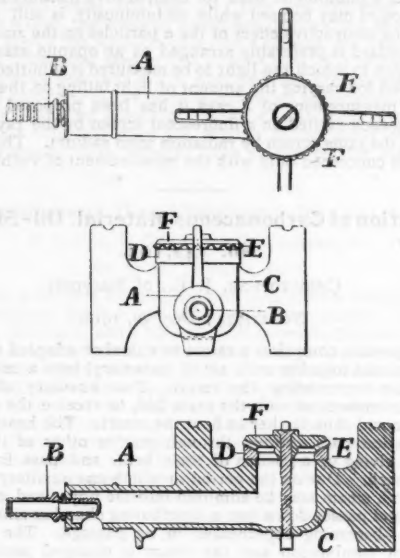
No. 26,717; Oct. 30, 1919.

This invention has for its object to provide an annular gas-burner of the atmospheric type formed of a radially corrugated ring of gas outlet passages between a pair of ring or disc parts having plain surfaces.

A plan, an end view, and a longitudinal section of such a gas boiling ring and burner are shown with this invention.

The boiling ring has a mixing tube A to one end of which the usual gas-nipple B is attached, terminating at the other end in a cup-like part C provided at its upper open end with an annular seating surface D. On this surface a radially corrugated metal ring E is placed; and above the ring is secured a metal disc F connected to the cup-like part by a central screw. Preferably, the corrugated ring and the surfaces between which it is clamped are inclined towards the centre, to give an upward inclination to the radial passages provided by the parts for the outflow of the combustible mixture.

Instead of corrugating the ring to form alternate passages on opposite sides of the ring as shown, the ring passages may be arranged in groups separated by blank portions; and the corrugations on one side



Yates and Adnitt's Atmospheric Gas-Burner.

may be of larger cross-section than those on the other side—thereby producing two rings of flame of different size. Also the outer ends of the corrugations on one or both sides of the ring may be caused to merge for the production of single flames at each group of passages.

The invention, it is said, enables outlet passages of large total area to be provided without any risk of lighting-back.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for May 27.]

Nos. 13,459—14,126.

ALEXANDER, C. J.—"Contrivance for adjusting the inflow of gas into burners." No. 13,890.
ANDERSON, T. R.—"Gas regulators." No. 13,814.
BAILEY, C.—"Apparatus for loading and conveying coal, &c." No. 13,858.
BARKER, A. H.—"Burner for gaseous fuels." No. 13,791.
CHARPILLOZ AND CO., L.—"Cocks and valves." No. 13,512.
COLBRAN, J. B.—"Incandescent gas-burners" No. 13,665.
COLBRAN, J. B.—"Inverted incandescent gas-burners." No. 14,076.
DUCKHAM, SIR A. M.—"Fractional distillation." No. 14,104.
FALL, T. A.—"Cocks and valves." No. 13,510.
JONES, A. C.—"Incandescent gas-burners, &c." No. 13,861.
LEWIS, G. P.—"Purification of gases." No. 13,554.
MARKS, E. C. R.—"Liquid flow meter." No. 14,089.
MARKS, E. C. R.—"Apparatus for compensating for turbulence in measurement of flow of liquids." No. 14,090.
MESSENGER AND SON.—See Jones.—No. 13,861.
METZ, A. H.—"Gas-ovens." No. 13,940.
QUAIN, J. R.—See Lewis. No. 13,554.
RAMBUSH, N. E.—"Removal of sulphur from gases." No. 14,106.
SAWTELLE, E. M.—"Destructive distillation of wood." No. 13,718.
SIMMANCE, J. F.—"Illuminant for photometric, &c., purposes," No. 13,898.
STOKOE, C. L.—"Pressure and temperature indicating apparatus." No. 14,056.
STUBBS, S. P.—See Jones. No. 13,861.
THERMAL INDUSTRIAL AND CHEMICAL (T.I.C.) RESEARCH COMPANY.—See Duckham. No. 14,104.
WADE, B. H.—See Marks. Nos. 14,089, 14,090.
WESTAWAY, J. C.—"Burning gas, vapour, &c." No. 13,476.
WESTF. GASGLÜHLICHT-FABRIK F. W., and DR. C. KILLING.—"Manufacture of inverted incandescent gas-mantles." No. 13,528.
WHEELER, F. CORNELIUS.—"Stoves and fire-places." No. 13,575.

Chesterfield New Gas Prices.—The Chesterfield Gas Board announce that, owing to the withdrawal of the rebate on domestic coal, the further rise in the price of coal, and the increases in wages and materials generally, they are compelled to raise the price of gas. The rates after the current quarter will be: Ordinary consumers, for lighting 4s. per 1000 c.ft., for cooking 3s. 6d., and for engines 3s.; slot-meter consumers for lighting 5s. per 1000 c.ft., for cooking, &c., 4s. 6d.

Electric Standards for Gas.—The Gas Engineer (Mr. E. W. Smith) reported to the Chelmsford Gas Committee that he had negotiated with the Electric Supply Corporation, Ltd., with regard to the acquisition by the Council of a number of the electric lamp standards which might be converted for gas-lamp purposes, and stated that the Company were willing to sell fifty of their standards at the price of 42s. 6d. each. The Committee resolved to recommend the Council to purchase the standards at the price named.

MISCELLANEOUS NEWS.

"B.C.G.A." CONFERENCE IN GLASGOW.

Housing Problems.

A business and housing conference, under the auspices of the Scottish District Committee of the British Commercial Gas Association, was held in Glasgow on Friday, May 21. In welcoming the assembly, Bailie M'Culloch (Senior Magistrate of the city) emphasized the importance of the relationship which the gas industry has with the housing problem. He said gas was one of the most important items in settling the housing question; and it was essential to have the best attention of the best intellects in the gas industry. He remarked that there had been grumbling during the war; and what was now looked for was good gas as cheap as possible. He mentioned the importance of being courageous in the matter of providing up-to-date plant, and stated that the better results would in a few years wipe-out all the outlay of capital incurred.

The morning session was occupied with the private business of the Association; and during this portion of the proceedings Mr. F. W. Goodenough (the Chairman of the Executive) addressed the meeting on the subject of the work and policy of the Association now and in the future.

Mr. F. H. Holland, the Association's Director of Sales Organization, spoke of the work being done by his department in the development of gas sales and reduction of commercial costs. In the course of the ensuing discussion, Mr. Alexander Masterton, of Edinburgh, said he felt that, as Mr. Holland was directing his whole attention to these important subjects, and ascertaining the methods adopted in different places—selecting the best in each, and embodying them in a thoroughly practical and concrete scheme—the conclusions could only result in considerable benefit to those in the industry who took advantage of the opportunities offered. Certainly Mr. Holland had gone to the very root of the matter, and shown how work could be carried on most economically and effectively by the adaptation of modern methods, careful organization, the use of proper tools, and the utilization of knowledge and experience to the best advantage. He (the speaker) was seriously considering the advisability of recommending the adoption of these schemes by his Commissioners.

A Discussion on Housing.

Mr. J. W. M'Lusky, of Glasgow, in opening a discussion on housing, said their chief concern in the matter was the successful use of gas for lighting, heating, and cooking; and provided they were allowed to carry out their own ideas from the main to the point of ignition, they could guarantee satisfaction. Most of them had experienced the difficulty of endeavouring to satisfy consumers whose residences were originally carcassed for lighting only, and who expected the same pipes to deliver an adequate supply to various up-to-date appliances. This was one of the most serious problems the gas industry had to solve. If a satisfactory service was to be maintained in the future, a very big task loomed on the horizon for their distribution departments. They would not be worthy of their salt if they did not soon arrive at some satisfactory method of meeting the expenditure involved in clearing out thousands of old services and internal supplies. Property owners were so badly hit during the war with rent restriction and the enormous cost of repairs, that they need hardly look in this direction for financial co-operation. The Glasgow Housing Authorities appreciated this difficulty; and while they were decidedly in favour of electricity for lighting, they were fully alive to the advantages of gas for all other purposes. The general arrangement adopted was to lay-on a supply to a cooker and wash boiler, and for gas-fires in the most likely rooms. In Manchester, they were considering proposals for central hot-water supply systems on two of their housing estates; and it was to be hoped that they might soon find, not only central heating by gas, but communal incinerators for household garbage, and the waste heat utilized for wash-house boilers. There was plenty of scope for the architects who were out for a purer atmosphere and more comfortable houses. It was a step in the direction of communal service to find in Glasgow about a dozen tenements with a gas supply laid on to the wash-house boiler, and a prepayment meter installed, so that each tenant paid her share in turn. They were out as far as possible to assist the over-wrought Cleansing Department; and the all-gas housing scheme was one of the most important factors in this work. Perhaps some day local rates would subscribe to a reduction in the price of gas for services rendered in preventing unnecessary pollution and expenditure. The continually recurring increases in the cost of labour and materials had had a very damping-down effect on their commercial enthusiasm; and their proverbial caution asserted itself vigorously in studying just how much they could spend to secure new business. As a matter of fact, many gas undertakings had been so handicapped from lack of plant that new business had been more dreaded than sought for. The financial aspect of the question engaged the serious attention of the General Committee of the "B.C.G.A." in London recently; and the discussion proved how difficult it was to lay-down a definite policy for the industry to pursue in connection with outlays necessary if gas was to maintain its place in the new housing schemes. It was estimated that during the next twenty years 57,000 houses would be built under the proposed Glasgow housing scheme—30,000 of the cottage type, at about £900 per house, and 27,000 tenement houses, at about £800 each. This meant a total money expenditure of about £48,000,000. Fortunately, nearly all the building sites were in close proximity to the existing mains, thereby removing the necessity of providing and laying costly lines of trunk mains. All internal pipes were at present supplied and fixed by the Housing Authorities, so that the expenditure of the Gas Department ended at the meter. There was a probability that the gas cookers might ulti-

Main's "Housing" Cookers.

HOUSES are building slowly yet surely, and the Government Department concerned with the nation's need in this respect has made its selection of cookers suitable for present and future schemes.

The Main "Surrey" Cooker on stand was an early choice, and this popular Stove has already been supplied in large numbers to those districts fortunate enough to have schemes certificated by Government.

The design, dimensions, finish, and price of the "Surrey" Cooker make it ideal in every respect.

May we send you our "Housing Problems" booklet. It will assist you with the Housing Schemes in your District.

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WORKS: Gothic Works, EDMONTON, N.18; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.1; 82, Gordon Street, GLASGOW; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE.

mately be purchased outright by the Director of Housing for the Corporation as part of the internal fittings of the houses. Speaking for the gas industry, he would suggest that before new houses could be reckoned a complete and up-to-date job, gas appliances ought to be part and parcel of the scheme, and looked upon as fixtures, thereby relieving tenants of the responsibility of installing the appliances at their own expense. Why should the builders of modern houses burden themselves with the cost of interior grates and expensive chimney-breasts, which in many instances were rarely in use? They knew from experience the vast number of gas-fires installed in front of interior grates. In pre-war days, building contractors in Glasgow had an arrangement with the Gas Department whereby apartments likely later on to be heated by gas were carcassed. Builders estimated their average expenditure on this work to be about 14s. per point; and they received a subsidy from the Gas Department of 2s. 6d. The builders reckoned to lose 11s. 6d. on the transaction, but evidently thought it worth while, as their houses were certainly made more attractive to tenants or purchasers. The Government subsidy to builders of houses had now been increased to speed-up the work. A portion of the subsidy was to be applied to the expenditure on gas-pipes and appliances, which would have the direct effect of rendering the new schemes more attractive from the point of view of the gas industry. The capital expenditure for the laying of mains and services, and the supply and connecting of meters to the first 2000 houses in Glasgow totalled approximately £32,000, or £16 per house. The consumption of gas would probably average 25,000 c.ft. per annum, or equal to a revenue of £5 a year; and interest on capital, maintenance of meters, and distribution costs on each new house, with this average consumption, would amount to 1s. 9·5d. per 1000 c.ft. of gas sold. Taking the selling price of gas at 4s. per 1000 c.ft., this left them 2s. 2·5d. for manufacturing charges. When it was noted that these charges in Glasgow last year amounted to 2s. 2·72d. per 1000 c.ft. sold, one could readily see that there must be either an increase in the price of gas sold or a decrease in the cost of production, if the housing schemes were to bear their fair share of the expenditure.

Mr. A. MASTERTON said that in Edinburgh a large and important scheme was being carried out in their western area, comprising the erection of 356 houses, in blocks of four each. It had been finally decided that neither the houses nor the roads were to be lighted by gas; and the Gas Commissioners were to be called upon to lay 1½ miles of mains, provide and fix services and meters, and instal cookers on loan and gas-fires on hire. The total expenditure involved, allowing for the additional manufacturing plant which might be required at the works, would amount to over £9000, or £26 per house. Their average consumption per ordinary consumer was only some 18,000 c.ft. per annum. In the case of those with prepayment meters, the average was just about 10,000 c.ft. per annum; and they might take it that the whole of the lighting was by gas. As they were not to secure the gas lighting in the new houses, he had struck an average consumption of 12,000 c.ft. per annum, which, at 5s. per 1000 c.ft., would only yield a revenue of approximately £1000 in the year. As their gross profit came to 1s. per 1000 c.ft., the return under this heading would be £210 per annum, or less than 2½ p.ct. on the total capital expenditure. He was of opinion that, where Housing Committees did not see their way to light by gas, but installed cooking appliances, burners, &c., gas undertakings should insist on a substantial contribution towards the capital expenditure. Failing this, the business was of little or no interest to them, as they were merely being exploited for the benefit of the electricity undertaking. Gas authorities could not be forced to put in new gas supplies to premises beyond 25 yards from the nearest main; and even in cases where the premises were within this distance, and pipes had to be laid, they could charge for everything over 30 ft.

Mr. ALEXANDER YUILL (Dundee) said he was not sure, if they had an area taken in by local authority, whether the local authority could compel them to lay mains without some surcharge on the cost of the mains. This was a point which might be explained. Even if the gas-works belonged to the local authority, could the local authority insist on the Gas Commissioners laying the pipes without some consideration, if they found that it was not going to pay?

Mr. GOODENOUGH said, provided that the buildings lay more than 25 yards outside their nearest mains, they could absolutely refuse to supply gas to the area except upon terms. There was another point to be borne in mind. Supposing the nearest portion of the estate was within 25 yards of the mains, naturally all the houses would have automatic meters, and he knew of no obligation under any Act to instal automatic meters except on terms. In London, they made terms with their Housing Authorities without any difficulty whatever. They made terms on the basis of a sliding-scale—the smaller the probable consumption, the higher the amount they were asking for putting-in supplies. If the Housing Authorities were willing to give them the lighting, they were prepared to put-in supplies for £9 per house. If they knocked out the lighting, they wanted £12 per house; and if they knocked out water-heating and fires, they wanted £15, because the smaller the return in consumption the larger the amount they required towards the cost of installation. They found the local authorities preferred to pay the smaller amount. He said that, though Housing Authorities might favour electricity for lighting, the tenants might not be in favour of it; and he instanced an estate in London put up by H.M. Office of Works, where a dual supply was put-in for electricity or gas, and the tenants were allowed to choose for themselves which they would have. Out of 1300 tenants, 1289 took gas and only 11 took electricity. The reason was perfectly obvious—the artisan desired an illuminant which in the colder weather would help to warm the room. There was no reason why gas undertakings should not require from Housing Authorities a fair contribution towards the cost of mains and services and installations. The only alternative was for the extra cost to fall upon all the gas consumers in the district; and this did not seem to be an equitable arrangement.

Mr. PETER FYFE (Director of Housing, Glasgow) said he did not

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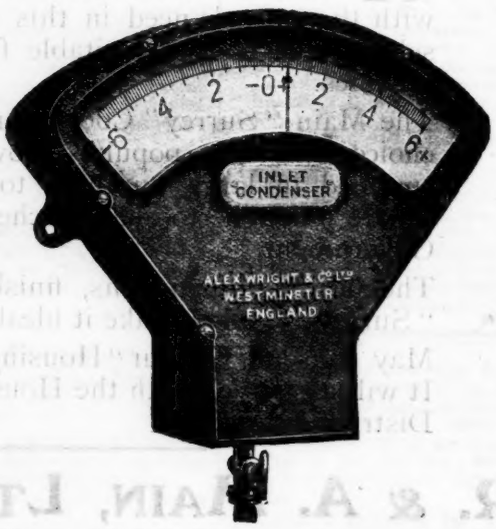

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think a person preferred gas in the house because it heated the room. He had always been a great advocate of the use of gas; and the chief argument, to his mind, in its favour was that air purification would thus be assisted. In Glasgow, owing to the smoke from house and factory chimneys, the solid matter that fell through the air was 1 ton per acre per annum. In London, it was a little less. He supported them in every possible direction in the introduction of gas into housing schemes. By some means, let them reduce their gas to 2s., instead of 4s. per 1000 c.ft., and they would find him and many others warm advocates for gas against coal.

Mr. W. M. MASON said he was delighted to hear Mr. Fyfe take the bigger, broader view of air purification and smoke pollution. The Glasgow Corporation had paid about £3,000,000 to purify the Clyde. Why not put it to them to subsidize the Gas Department so that they could reduce the cost of gas to 1s. 6d. or 2s. per 1000 p.ct.?

Mr. J. W. NAPIER (Alloa) doubted if it was true that cheap gas was a necessity for the abolition of the use of coal. The evidence was not quite satisfactory on this point. For many years the price of gas in Alloa had been in the vicinity of 2s. per 1000 c.ft.; and yet, due to sentiment and tradition, the use of coal there was enormous. He did not think anything short of the authority of the Government to compel people to cease using coal and take advantage of gas would bring about the changed conditions to which they looked forward. In Alloa, the Housing Authority had made no objection whatever, not only to paying for cookers and wash-boilers, but also for such lengths of gas service-pipe as were in private ground. They had thus been relieved of a very considerable amount of capital expenditure. Remembering that the "B.C.G.A." office was in London, and they were in Scotland, he thought they ought to have some Local Committee in Scotland who would be watchful of the interests of the gas industry in the matter of housing.

Mr. GOODENOUGH suggested that the representatives from Scotland on the General Committee might constitute themselves a Committee to watch the interests of gas undertakings in regard to housing.

Mr. A. KELLOCK (Airdrie) said his Town Council, in considering the question of introducing gas or electricity, had gone into the matter with an open mind. They invited tenders for both; and it was found the cost of installing gas was very much less than for electricity.

Mr. D. VASS (Perth) said that, as an experiment, they had fitted 300 houses at a cost of something like £3 a house for internal fittings, apart from the ordinary capital charges; and the outlay was being met by a levy of 3d. per 1000 c.ft. over a period of years. There might be a plan such as this for supplying gas to new housing schemes.

Dr. HARVIE (Dunfermline) did not see why the bulk of gas consumers should have the price kept up or increased because of a small section. It was only relieving the Government of a legitimate burden they ought to bear.

Mr. GOODENOUGH moved a cordial vote of thanks to the Corporation of Glasgow, and coupled with it the name of the Chairman, Councillor Somerville. Referring to some points in the discussion, he said that in England the Ministry of Health had raised no difficulty about passing items in housing schemes put up to them by Housing Authorities, which covered part cost of gas installation, providing nothing was set out which the gas undertaking had been accustomed to do free. The Ministry were also quite in favour of gas economy flues, and had sent the Association a copy of the instructions they proposed to issue to Housing Authorities. This was quite a score for the Association. They had been pegging-away at them for months; and now the Ministry proposed to take the matter up.

GAS-WORKS PURCHASE QUESTION AT STOKE-ON-TRENT.

Power to be Sought to Acquire the Potteries Works of the British Gas Light Company.

At the Quarterly Meeting of the County Borough Council of Stoke-on-Trent, on Thursday last, the question of the proposed purchase of the British Gas Light Company's local undertaking was discussed in private for a considerable time. The report made by the Gas Committee last March was that they had further considered the concentration of the manufacture of gas for the district, and, in connection therewith, the proposal to purchase the local undertaking of the British Gas Light Company, Ltd. They recommended that the Town Council proceed to obtain compulsory powers to acquire the local gas undertaking of the Company, and that the Town Clerk be authorized to take all the necessary steps in the matter.

At the open meeting of the Council, the Mayor (Alderman W. E. Robinson) said that the recommendation had been carried; and he appealed to the members of the Council that in any discussion no word should be said which would be likely to prejudice the Corporation in their proceedings to acquire the undertaking. After the recommendations had been formally moved and seconded, Mr. F. Collis made an emphatic protest at the way the matter had been conducted. He remarked that the proposer and seconder of the Gas Committee's recommendations had not said one word in open Council to justify to the ratepayers their reasons for the purchase of the Company's undertaking. The ratepayers had a perfect right to know the facts when it came to the expenditure of a sum of money so large as had been mentioned in Committee; and the Council had no right to embark upon an expenditure of such magnitude without fully justifying their position to the ratepayers.

Mr. C. H. Bowers, the Vice-Chairman of the Gas Committee, said that, as business men, they were bound to preserve secrecy both as to figures and details in a matter of this kind. The Gas Committee had very carefully considered the scheme of the Engineer (Mr. A. Mackay), and had dealt with the matter as if they were spending their own money. The scheme meant concentrating, and he was prepared to risk what business reputation he had in backing the scheme from A to Z. It was commercially sound; and he would be quite content to have his

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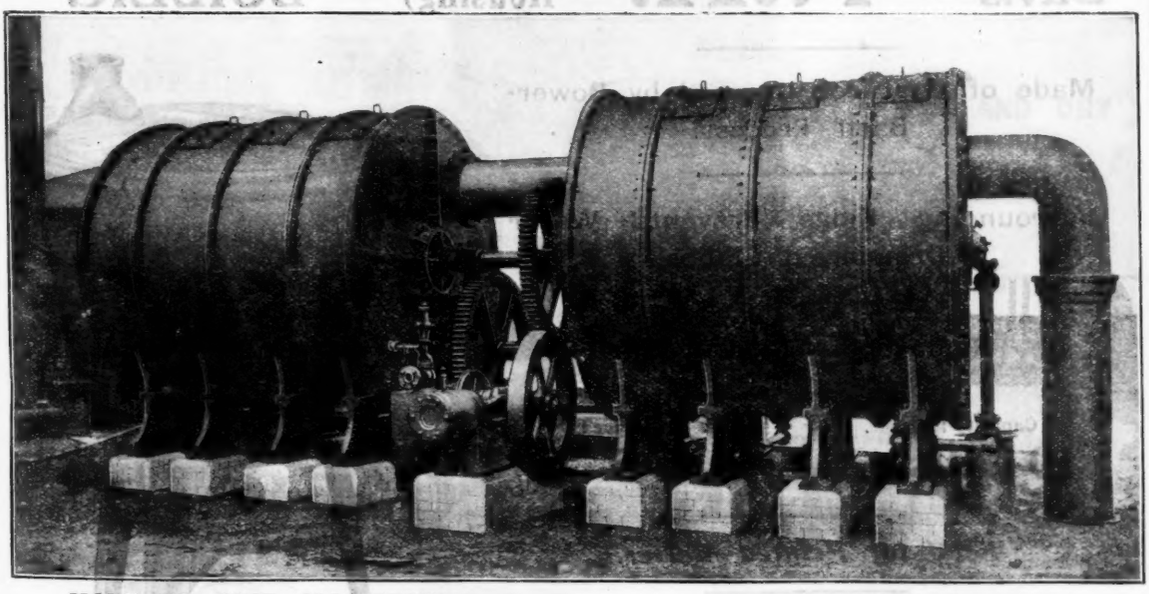

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own money in it. Alderman J. S. Goddard, the Deputy-Mayor and Chairman of the Finance Committee, asked the Council to weigh what were likely to be the advantages of the scheme as against the obligations they would incur. The only thing that might accrue was some possible reduction in the price of gas; for they were prohibited from relieving the rates from any profits of the undertaking. He quoted figures of the liabilities of the Corporation in loan charges, prospective loan charges, expenditure which had been sanctioned, and expenditure which was likely to be incurred in the near future, and declared that the amount came to the grand total of £2,044,559. In view of this figure, he was of opinion that they ought not to embark on a scheme which would involve them in an expenditure of £1,000,000.

The Mayor said that the Deputy Mayor had always been a consistent opponent of municipal schemes of the kind now before the Council, and quite honestly had a prejudice against them. He (the Mayor) believed that centralization was part and parcel of the scheme of federation, and was one of the reasons why federation had been brought about. The Deputy-Mayor had said that nothing was to be gained by the scheme except a reduction in the price of gas. But was not this an advantage to almost every section of the community? Centralization and the most up-to-date methods of production were what all commercial men were thinking about to-day; and they must apply this to their municipal undertakings. The justification for the scheme was that the Council were absolutely bound to free an expenditure of over £200,000 on the existing works; and he pointed out that in coal alone they would save 21,000 tons annually. Alderman A. Colclough supported the Committee. He prophesied that in the near future gas would be the principal firing agent in the potting trade.

The recommendations were carried; only a few of the members dissenting.

BRITISH DYESTUFFS CORPORATION.

The Annual General Meeting in Manchester of the British Dyestuffs Corporation was presided over by Sir Henry Birchenough, Bart., K.C.M.G. (the new Chairman); and he paid a warm tribute to the services of Lord Moulton, who resigned the position on resuming his judicial duties. He said that Lord Moulton's wide technical knowledge and varied experience had been of great value to the Corporation, and his close association with it had inspired confidence in the Company's undertaking. He would ask them to allow him to express their thanks to Lord Moulton for his services to the Company and to the dye industry of Great Britain. Though Lord Moulton's official connection with the Company was severed, he had been good enough to promise to place his great knowledge and experience at the disposal of the Board whenever they might wish to seek his counsel. The Board of Trade had selected a distinguished and experienced administrator in Lord Ashfield to succeed Lord Moulton as one of the Government Directors. As President of the Board of Trade, Lord Ashfield (or, as he then was, Sir Albert Stanley), gained in an unusual degree the confidence of the industrial community as a sound and practical business man. During his period of office the dye question was a critical question always with him. As a Minister, he realized its truly national importance, was fully versed in its many aspects, and probably no man was better acquainted than he with the circumstances that led up to the formation of the Corporation.

He believed it was almost impossible to over-estimate the value of the German dyestuff industry to the German Government in the recent war, or the power which the industry had placed in the hands of our enemies to prolong the conflict. Whether considered as the means by which the Germans were able to counterbalance the effect of the blockade on the manufacture of high explosives, or as the means by which they were able to revolutionize warfare by the introduction and use of those toxic substances which added so much to the horrors and destructiveness of war, the German dyestuff industry was an institution of supreme importance. He was informed that, with one single and insignificant exception, the whole of the poison gases used by the German army were made in the establishments of the German dye manufacturers. What they had done in the past they could perfectly well do again in the future, so long as their dyestuff factories remained intact and their dyestuff industry maintained its world-wide importance. If in course of time another great war should come, they must be prepared for further great developments of chemical warfare. This meant that it was of absolutely vital importance to have in this country great industries so completely endowed with chemical knowledge and practice, and so efficiently equipped with plant that they could at once be employed to meet readily and amply the requirements of national defence. Turning to the equally important aspect of the dyestuff industry as an essential element in the defence of British trade, he said that the group of textile trades of this country constituted the most striking and important single group of allied industries in the civilized world. They had only to look through the export returns to see that this country shipped textiles in varying quantities to every country on the map. The magnitude and very existence of a very large part of this export trade in textiles depended absolutely upon there being, at all times, a sufficient supply of dyestuffs available for the use of the trades. Dyemaking was indeed a key industry—that was to say, it was a comparatively small industry upon which other very large industries absolutely depended for their very life.

The Directors of the Corporation realized the fundamental importance of the undertaking to all the dye-using industries and to the nation at large. The object the Board were keeping steadily before them was to establish and develop a great organization, which would supply the needs of British consumers of synthetic dyestuffs, and protect them from the menace which would arise from a return to dependence upon some foreign source of supply. The problem was a big one, and a difficult one. Its solution would require time and patience, and all the aid that science and technical skill could give. The Directors had made a very close study of the problem, and had prepared, and were carrying out, a programme of both research and construction

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which they believed would enable the Company to achieve the great objects for which it was formed. They had, he believed, under the general direction of Dr. Herbert Levinstein, the Technical Managing-Director, the largest research organization in Great Britain. There was included within it some of the very finest scientific ability which could be obtained in this country. Their Research Department at Blackley was under the charge of Mr. A. G. Green, a Fellow of the Royal Society, who had been associated in a most distinguished manner with the British dyestuff industry for many years. The department at Huddersfield was controlled by Dr. R. Robinson, who was also a Fellow of the Royal Society, and one of the most brilliant of the younger generation of English chemists. They were also employing about a hundred chemists of high attainments—all continuously engaged on research; and the scheme contemplated a systematic survey of the whole field of dye manufacturing. Much of the field, he was glad to say, had been covered, and processes prepared which served as a guide to the constructional department. With this organization, they felt satisfied that they would be able in time to solve the many difficult technical questions which presented themselves. The Corporation had received from the Government for research purposes the sum of £100,000, which was promised to British Dyes, Ltd., on the creation of that Company.

It could not be denied that the British dyestuff industry, as a whole, and the undertaking of the Corporation in particular, had made very substantial progress indeed in the last five years. He had only to tell the shareholders that they were employing nearly 6000 workpeople, and that the total staff was over 7000, to enable them to realize the scale on which they were operating. The British dye industry to-day was really large and important, and its output exceeded the total consumption in this country before the war. Moreover, the output was almost entirely based on British-made materials and intermediate products.

The report was adopted, and a dividend declared on the preferred ordinary shares at the rate of 8 p.ct. per annum (less income-tax).

Mr. A. Potts, J.P., presiding over a social gathering organized by the Bolton and District Gas-Workers' Association, presented a silver watch to Mr. John Stones (President) and an inkstand and fountain pen to Mr. Thomas Muschamp (Vice-President), referring in appreciative terms to their services and loyalty.

Mr. William Chew, the Gas Engineer and Manager, has reported to the Blackpool Gas Committee that the income for the past financial year amounted to £169,198, compared with £150,357 for the preceding year; and the expenditure to £149,048, against £123,819. The disposal balance is £3636, compared with £10,326. As the estimated profit was only £427, the department did well. At March 31 last the total capital outlay was £245,130, with a net indebtedness of £86,447. There will probably be a further increase in the price of gas after June 30.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 31.

Except for odd parcels, shipments of pitch for the present season are at an end. For next season there are many buyers, and business is reported at over 155s. per ton net f.o.b. makers' works. Creosote is in demand at from 1s. 1d. to 1s. 2d. per gallon net and naked. Pure benzol, pure toluol, and 95-160 solvent naphtha are about 3s. 3d. to 3s. 6d. per gallon filled into buyers' drums at makers' works. Pyridine bases 90-140 are from 17s. 6d. to 20s. per gallon. Naphthalenes are in request at advancing prices.

The prices for sulphate of ammonia for home agricultural use over the next twelve months have now been fixed; the price for June being £23 10s. per ton, basis 24½ p.ct. to farmers, in single bags.

Tar Products in the Provinces.

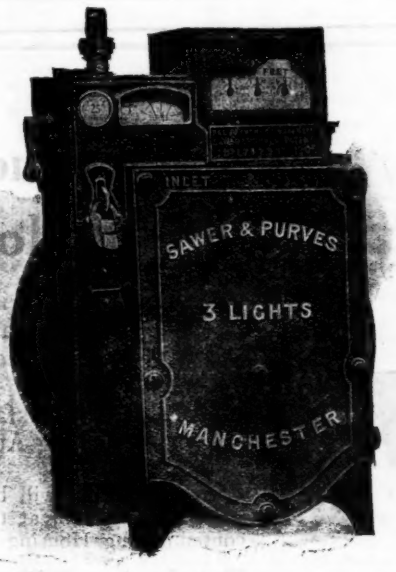
May 31.

The average values for gas-works products during the week were: Gas-works coal tar, 94s. to 99s. Pitch, East Coast, 160s. to 165s. per ton f.a.s.; West Coast—Manchester, 135s. to 140s.; Liverpool, 135s. to 140s.; Clyde, 140s. to 145s. nominal. Benzol 90 p.ct. North, 2s. 6d. to 2s. 7d.; crude 65 p.ct. at 120° C., 1s. 7½d. to 1s. 8½d. naked at makers' works; 50-90 p.ct. naked, North, 2s. 4d. to 2s. 6d. Toluol, naked, North, 2s. 6d. to 2s. 7d. nominal. Coal tar crude naphtha in bulk, North, 11½d. to 1s. Solvent naphtha, naked, North, 3s. 1d. to 3s. 3d. Heavy naphtha, North, 3s. 4d. to 3s. 6d. Creosote, in bulk, North, liquid, 11½d. to 1s.; salty, 10½d. to 11¼d. Heavy oils, in bulk, North, 1s. to 1s. 0½d. Carbolic acid, 60 p.ct., 4s. to 4s. 1d. Naphthalene, £35; salts, £9 to £9 10s., bags included. Anthracene, "A" quality, 9d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

There has been very little business during the past week. Although there is no weakening, there is a difficulty in fixing real dealing prices, since many people are inclined to think the top has been seen. Pitch, however, still maintains strength, and continues on the up-grade. Although there is good inquiry for forward positions, the cost of patent fuel on the Continent and elsewhere is now almost prohibitive, and must lead to a slackening of demand. Benzols are steady, and no change in quotations has been announced as yet. Creosote is a good market, and further appreciation is anticipated. There is no change in the position of carbolic acid. The trade is unable to understand why it is prevented from taking part in the export trade while the acid is still going out. A searching inquiry is to be demanded when Parlia-



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ment reassembles. Prices of both crude and crystal are a shade dearer. Cresylic acid is steady. Naphthalenes are wanted, and pure descriptions are relatively scarce and daily becoming dearer. Solvent naphtha keeps firm; and there is a prospect of fair demand. Heavy naphtha is dearer. A recent judgment permits the railway companies to classify "certain coal-tar products of the naphtha order" as dangerous goods, and to increase rates accordingly. The definition is obscure, and the trade does not agree with the verdict, in view of the freedom from fire which has characterized this traffic for years. Supplies of intermediate products are rather more plentiful; but export inquiries are still very insistent, although they cannot be satisfied.

Latest quotations are as follows:

Benzol: 90% London 2s. 5d. to 2s. 7d., North 2s. 4d. to 2s. 6d.; 50-90% 2s. 3d. to 2s. 4d. London, 2s. 2d. to 2s. 3d. North; crude 60-65%, 1s. 6d. to 1s. 8d.; pure, 3s. 3d. per gallon naked.

Crude Tar: London, 77s. 6d. to 80s.; Midlands, 75s. to 77s. 6d.; North, 75s. to 80s. per ton *ex* works. Refined tar, 55s. per barrel (free) on rail.

Pitch: London, 155s. per ton; East Coast, 145s. to 150s. per ton; West Coast, 140s. to 150s., with Manchester 150s. per ton, and Glasgow 150s. per ton; South Wales, 155s. per ton.

Solvent Naphtha: London, 3s. 6d. Provinces average 3s. 4d. per gallon.

Crude Naphtha: Naked, 10d.; North, 9d. per gallon.

Heavy Naphtha: 3s. 6d. per gallon.

Naphthalene: Refined, £40 per ton nominal; inferior, £30; crude, £14 to £22, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North, 2s. 7d. Pure, 3s.

Creosote: London, 1s. 1d. to 1s. 2d.; North, 1s. 1d.; heavy oil, 10½d. per gallon in bulk.

Anthracene: 40-45%, 9d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works

Aniline Oil: 1s. 5d. to 1s. 6d. per lb., drums extra.

Aniline Salts: 1s. 10d. to 2s. per lb.

Cresylic Acid: 95%, 4s. 3d. to 4s. 6d.; 97-99%, 4s. 6d. to 4s. 9d. per gallon *ex* works London, f.o.b. other ports.

Carbolic Acid: Crude 60%, 4s. 3d. per gallon; crystals 40%, 1s. 4d. to 1s. 5d. per lb. (nominal).

Salicylic Acid: Technical, 3s. 6d. to 3s. 9d.; B.P., 3s. 9d. per lb.

Sulphate of Ammonia.

The demand is still good, and all orders executed from to-day will be at the new season's rates—viz., £23 10s. per ton for June and July, increasing 10s. per ton per month until £27 10s. is reached in March, April, and May of next year. These prices are for four-ton lots, in makers' 2-cwt. bags, delivered to users' nearest station. The export price has now touched £45, so that the home user still has a very considerable advantage compared with the overseas buyer. The question of prices was recently raised by the West India Committee, who argue that the West Indies buyers should not be compelled to pay for this fertilizer, which is to be used in the production of foodstuffs for consumption in this country, often as much as double the amount asked of the home agriculturist engaged in the same pursuit. They feel that if there is any surplus after home needs are satisfied, it should be available for export to the Colonies at the same price as is asked of the farmer in Great Britain. The Ministry of Agriculture have, however, pointed out that the Sulphate of Ammonia Association, who control the sale, are free to obtain the world's market price for any surplus after home needs have been supplied; the Association have instead sold the product to the West Indies "at prices considerably lower than those obtained from foreign countries." The Ministry feel therefore that they cannot reasonably ask the Association to make any greater concession. The problem undoubtedly presents many difficulties, and can only be solved by larger production. We are promised a great development of synthetic ammonia in this country; but heavy expenses are to be incurred in connection with its manufacture So that no appreciable reduction is looked for from this source. Meantime, the present price of nitrate of soda more than justifies the export prices for sulphate of ammonia. Nitrate of soda at £25 per ton is equal to sulphate of ammonia at £32 10s.

The Campbell Gas-Engine Strike.—Contrary to general expectations, the long dispute which has been going on between the Campbell Gas-Engine Company, of Halifax, and their employees, with respect to the employment of ex-service men without having first made some arrangement with the Trade Union connected with the employees, has not been settled. The meeting called last Thursday, through the good offices of Mr. J. H. Whitley, M.P., the Deputy-Speaker of the House of Commons, duly took place; and after two hours' consideration, the proposed terms of settlement were almost unanimously turned-down. The meeting was held under the auspices of the Halifax Engineering Joint Trades Committee. It is, however, still possible for a settlement to be effected, as the door remains open for further negotiations.

Huddersfield Gas-Works Dispute.—Reports early last week pointed to the probability of another strike taking place in the Huddersfield Corporation Gas-Works carbonizing department, in consequence of the dismissal in March of J. Storey, the Branch Secretary of the National Union of Gas Workers, and another man named Hepworth, whose work was unsatisfactory owing, it is alleged, to their being drunk. The district officials appealed for the men to be reinstated, saying that they had already been punished enough by being thrown out of employment. A deputation waited upon the Gas Committee, who agreed to an inquiry with respect to Storey's case—later facts having been ascertained; but the operatives declined the offer, and handed-in their notices. The threatened strike has since been postponed till to-day, June 1. The postponement was largely due to the efforts of local labour leaders, who were anxious for a settlement being arrived at without such a drastic step being resorted to. The temper of the men is, however, stated to be very obdurate.

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Branch Works: Phœnix Foundry, Sheffield.

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Dudley Gas Company and Proposed Purchase.—In regard to the suggested purchase of the Dudley Gas-Works by the local Town Council, a Committee of the latter have received a communication from the Company to the effect that the Directors are not at present prepared to treat with the Council for the sale of the undertaking. Should the Council, however, pass a definite resolution to purchase, they would, subject to the approval of the shareholders, sell at a price to be fixed by arbitration. The Directors state that they consider it would be premature to allow any investigation of their books at the moment.

Nottingham Gas Fatality.—The death of a widow from gas asphyxiation and the narrow escape of her two young children was investigated by the Nottingham City Coroner last Thursday. The mother was discovered lying dead in bed, with the children unconscious. The window was closed, and the room full of gas. The elder child, aged eight, went downstairs early in the morning to prepare a cup of tea for her mother, and on returning to the bedroom lighted the gas. She subsequently, as she thought, turned the gas off; but after extinguishing the flame, she must have accidentally turned the tap on again. A verdict of death from gas poisoning was returned.

Bahia Blanca Gas Company, Ltd.—In submitting to the shareholders the accounts of the Company for the year ended Dec. 31 last, the Directors state that, including the debit balance of £26,090 brought forward from 1918, there was a total debit balance at the end of the year under review of £35,931. The adverse effects of the war continued during the year; but despite the great difficulties in obtaining fuel, the supply of gas has been well maintained. Coal has been practically unobtainable; and the practice of making gas from various native woods and native and other oils has had to be continued. The new generator has been successfully used during the year; but at times it was found necessary to put the old retorts into operation, in order to augment the supply, with the result that the working was adversely affected. During 1919 the receipts for gas sold decreased by 3·13 p.c. as compared with the previous year. Latest reports from Bahia Blanca indicate that the crops have been good; but while this will ultimately increase the prosperity of the port, and consequently help the Company, the immediate effect has been to increase labour charges, owing to the fact of the farmers paying higher wages. The holders of participating debenture stock have passed a resolution waiving interest for a period of three years from Jan. 1 last.

STOCK MARKET REPORT.

THE Stock Exchange reopened on Tuesday for business; but little of it came to hand—in fact, the week was generally pronounced to be one of the quietest noted for many a long day. The fine, warm weather and the sportive season were chiefly responsible for this state of things. The tone, however, was quite cheerful at first; but gradually the lack of support, owing to inaction, produced dulness.

The gilt-edged market did very well up to a point, and Home Government issues made daily advances. Before the close, some of this gain had been lost; but nevertheless the final prices were fractionally better—viz., Consols 47⅞-48⅜, War Loan 86-86 16/32, Funding 69⅜-70½, Victory 79½-80½. Bonds were firm. Home Rails were mostly quiet; but the demand for prior charges was maintained. Canadians were better; but Argentines weakened.

The Foreign Market was very irregular, but mostly flat, with slight momentary attempts at a rally.

The Miscellaneous Market showed no promise of recovery; most lines continuing very dull, and sellers predominating. Rubber and Oils moved fitfully, and Shipping, Textiles, and Iron and Steel were easier.

Business in the Gas Market was even quieter than the week before, and, if the two leading London issues be excluded from consideration, the week's marked transactions would work out at about a score. In spite of this torpor, however, the tone was decidedly steady, and with promise of improvement. Gas Light ordinary was done daily at steady figures; and the quotation was drawn in closer. South Metropolitan was in demand; and buyers raised their price by 2. Commercial was rather better. In Suburban and Provincial, Brentford "A" and "B" were quoted at advances of 2 and 3 respectively; and Alliance and Dublin changed hands at a better price. Imperial Continental was out of favour and little dealt in; the quotation falling 3. Primitivas had but one bargain. The proprietors will meet this day week to consider the position.

Bargains done for cash during the week were as follows: On Tuesday, Gas Light ordinary 56½, 57, 57½, 57⅞, 57½, 57⅝, 58, Imperial Continental 128, 130, Lea Bridge 80, Primitiva preference 37s. 6d., South Metropolitan 57, 59½, 60, South Suburban 65. On Wednesday, Gas Light ordinary 56, 56½, 56¾, 57¼, 57⅜, 57½, 58, 58¼, Imperial Continental 129, South Metropolitan 58, 60. On Thursday, Alliance and Dublin 41, Brentford "A" 50, Commercial 4 p.ct. 50, 50½, Gas Light Ordinary 56¾, 57, 57¼, 57½, 58, 58¼, ditto maximum 37, 38, Imperial Continental 127, 128½, 129, Liverpool 52⅝, South Metropolitan 58½, 59, 59½, 60, ditto preference 93. On Friday, Alliance and Dublin 41, Brentford "B" 50, Commercial 4 p.ct. 50, 51, 51½, Continental Union 29½, 30, European 6, Gas Light ordinary 57, 57½, 57½, 57⅝, ditto maximum 37, Imperial Continental 129, Liverpool 52⅝, Monte Video 71½, South Metropolitan 59, ditto debenture 47.

In the Money Market there was a strong and growing demand all the week up to Friday, when the stringency somewhat relaxed. Silver cheapened materially. The Bank rate is 7 p.ct., as fixed on April 15.

The Llanidloes Gas Company have given notice that they intend to apply to the Board of Trade for permission to increase the price of gas from 6s. 8d. to 10s. per 1000 c.ft.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Shares.	When ex-Dividend.	Ante-War Dividend & Bonus. p.c.	Last Dividend.	NAME.	Closing Prices, July 28, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
125,049	Stk.	Mar. 11	4	4%	Aldershot 4 p.c. Pref.	..	58—63	
1,551,868	"	Mar. 26	5½	3.5.%	Alliance & Dublin Ord.	39—34	37—42	41
274,800	"	Jan. 15	4	4%	Do. 4 p.c. Deb.	76—79	61—63	..
250,000	5	May 13	7½	8%	Bombay, Ltd.	5⅞—6⅛	4½—5½	..
50,000	10	Feb. 26	16	10%	Bournemouth Gas and Water { 10 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	29—30	8½—9	..
888,110	10	"	7	7%		15—15½	9—10	..
115,000	10	"	6	6%		13½—14	8½—9	..
162,065	—	Dec. 30	—	4%		..	64—66	..
992,845	Stk.	Feb. 12	14	30/-	Brentford A Consolid.	261—266	47—52	50
784,928	"	"	11	26/8	Do. B New	204—209	45—50	50
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	70—75	..
231,498	"	Dec. 11	4	4%	Do. 4 p.c. Deb.	91—98	64—66	..
214,775	"	Mar. 11	11	7½%	Brighton & Hove Orig.	208—213	121—126	..
244,366	"	"	8	6½%	Do. A Ord. Stk.	154—159	80—85	..
1,287,500	Stk.	Feb. 26	5	5%	Bristol 5 p.c. max.	..	..	..
680,000	20	Apl. 14	13½	10%	British	44—46	24—26	..
130,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	59—61	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	47—50	..
100,000	10	May 27	—	—	Cape Town & Dis., Ltd.	1½—2½	7—7½	..
180,000	10	"	—	4½%	Do. 4½ p.c. Pref.	4—6	5½—6½	..
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	55—63	..
187,158	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	..
1,613,380	"	Feb. 26	5/9/4	33/4	Commercial 4 p.c. Stk.	105—108	48—53	50—51½
500,000	"	"	5½	26/8	Do. 3½ p.c. do.	103—105	44—49	..
475,000	"	Dec. 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	46—49	..
500,000	"	"	4	—	Continental Union Ltd.	76—79	27—32	29½—30
220,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	40—60	..
51,500	Stk.	Feb. 26	14½	10½%	Croydon A 10 p.c.	..	130—140	..
276,408	—	"	11½	7½%	Croydon B and C 7 p.c.	..	90—100	..
495,378	Stk.	—	6	6%	Derby Con. Stk.	138—138	..	..
55,000	"	—	4	4%	Do. Deb. Stk.	103—104	..	..
1,905,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	6—7	6
16,396,975	Stk.	Feb. 12	4/11/4	30/-	Gas Light and Coke { 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb. 10 p.c. Bonds	98—102	56—59	56—58½
2,600,000	"	"	3½	23/8		75—79	38—43	37—38
4,029,195	"	"	4	4%		95—99	55—58	..
4,574,258	"	Dec. 11	3	3%		73½—74½	45—48	..
130,000	"	"	10	10%		..	..	..
29,500	"	Mar. 11	5	33⅓%	Hastings & St. L. 5 p.c.	..	55—60	..
255,748	"	"	2½	25%	Do. 3½ p.c	37—39	33—43	..
70,000	10	May 13	11	7%	Hongkong & China, Ltd.	15½—15⅝	8½—9½	..
121,629	Stk.	Mar. 11	9	6½%	Hornsey 7 p.c.	..	88—93	..
121,629	"	"	7½	5½%	Ilford A and C.	131—134	86—91	..
85,720	"	"	6½	4½%	Do. B	115—118	65—70	..
65,580	"	Dec. 30	4	4%	Do. 4 p.c. Deb.	93—94	57—60	..
4,949,090	"	May 14	9	4½%	Imperial Continental	126—129	127—132	127—130
1,338,020	"	Feb. 12	8½	6½%	Do. 5½ p.c. Deb. Red.	84—86	80—85	..
285,742	"	Mar. 26	6½	5½%	Lea Bridge Ord. 5 p.c.	119—121	80—85	80
2,498,986	"	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A B	211—213 146—148	..	52½
200,000	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	..
105,720	"	Feb. 26	7/5/6	35%	Maidstone 5 p.c.	..	52—57	..
15,000	5	June 11	5	5%	Malta & Mediterranean	4½—4⅝	1½—2½	..
250,000	100	Apl. 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	89—96	..
541,920	Stk.	May 27	4	6%	Monte Video, Ltd.	11½—13	70—75*	71½
1,078,622	"	Feb. 26	4½	3½%	Newcastle&Gatsh'd Con.	99½—99½	62—64	..
695,765	"	Dec. 30	5½	5½%	Do. 5½ p.c. Deb.	95—99	55—57	..
15,000	10	Mar. 11	—	8⅓%	North Middlesex 10 p.c.	..	18—18½	..
55,943	10	"	7/14/0	6½%	" 7 p.c.	14—15	8½—9½	..
800,000	Stk.	May 13	8	8%	Oriental, Ltd.	117—122	103—105	..
60,000	5	mar. 26	10	1/-	Ottoman, Ltd.	7½—8½	4½—5½	..
60,000	50	Mar. 11	13	7½%	Portsea, Island B	126—131	66—71	..
180,000	50	"	12	6½%	Do. C	118—121	53—58	..
249,998	5	April 29	6	—	Primitiva Ord.	5½—6	1—1½	..
499,998	5	June 26	6	—	Do. 5 p.c. Pref.	4½—5	1½—2½	37/6
631,500	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	91—93	70—73	..
600,000	Stk.	Jan. 29	4	4%	Do. " 1911	..	47—50	..
848,198	"	Dec. 30	4	4%	River Plate 4 p.c. Deb.	85—87	47—50	..
152,000	10	Mar. 26	6	6%	San Paulo { 5 p.c. Pref. 5 p.c. Deb.	12½—11	7½—7½	..
125,000	50	Dec. 30	5	5%		4½—49	39—41	..
125,000	Stk.	Mar. 11	10	50%	Sheffield A	228—234	69—73	..
209,264	"	"	10	41%	Do. B	223—234	68—68	..
223,580	"	"	10	35/5	Do. C	220—229	54—57	..
125,001	Stk.	Sept. 13	4	4%	Shrewsbury 5 p.c.	..	..	..
99,000	10	Oct. 15	9	10%	South African	12½—11½	12—13	..
6,669,295	Stk.	Feb. 12	5/4/0	30/-	South Met. 4 p.c. Ord.	111—113	58—61	57—60
250,000	"	Jan. 15	—	6%	Do. Pref.	..	93—95	93
1,895,445	"	"	3	3%	Do. 5 p.c. Deb.	72½—74½	45—48	47
224,220	"	Feb. 26	3½	3%	South Shields Con. Stk.	151—159	103—104	..
1,057,795	"	Aug. 14	6	3.3%	S'th Suburb'n Ord. 5 p.c.	114—116	64—69	65
247,528	Stk.	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	115—118	78—83	..
647,140	"	May 13	7½	3.3%	Southampton Ord.	95—122	57—60	..
121,275	"	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	..	61—63	..
190,000	"	Aug. 14		3.3%	Tottenham { A 5 p.c.	126—128	60—65	..
793,275	"	"	6	2.2%	District { B 5½ p.c. 4 p.c. Deb.	115—117	45—50	..
181,255	"	Dec. 11	4	4%		87—89	61—64	..
123,850	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	..
295,475	Stk.	Mar. 11	5	3.2%	Tynemouth 5 p.c. max.	103½—109	71—73	..
80,809	"	Feb. 26	3½	35/-	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	131—136	86—88	..
255,626	"	"	6½	40/-	Do. B 5½ p.c.	120—124	81—86	..
108,075	"	"	—	38/6	Do. C	..	61—65	..
140,885	"	"	—	38/6	New Ordinary	..	61—65	..
351,000	"	"	6½	38/9	Wimbledon 5 p.c.	117—122	63—68	..
96,000	"	"	6½	40/-	Epsom 5 p.c.	121—126	63—68	..
85,415	"	Dec. 30	5	5%	p.c. Deb. Stk.	88—89	48—50	..

Production from the British Coalfields.

Mr. David Gilmour, O.B.E., has contributed an article to the May number of the "Industrial League and Council Journal," in which he deals with the subject of coal production. He is the General Secretary of the National Democratic and Labour Party, and speaks from experience gained through a long connection with the coal-mining industry of Great Britain. The production from the British coalfields for the last normal trading year prior to the outbreak of war amounted to 287 million tons; and Mr. Gilmour says there is no doubt that, if peace conditions had continued, the normal expansion of trade would have resulted in further increased production until an output of at least 300 million tons was reached. This, he thinks, would not be more than is demanded to meet existing trade requirements. The capacity for production from the mines under the seven-hour day seems to have reached the limit; and statistics indicate that, making allowances for the various factors in connection with output, we shall come out very well indeed if the output reaches 240 million tons per annum, whereas 300 million tons could be disposed of without much difficulty. This figure cannot be reached for many years with the seven-hour day in operation. Mr. Gilmour says that, as the seven-hour day was mutually agreed upon, any alteration can only be made by mutual agreement. His suggestion, therefore, is that it should be made worth the while of the miners to consider reverting back to the eight-hour day for the period of one year on trial; and for the extra hour worked they might be paid a higher rate, as for overtime. Supposing the concession of £1 per week higher wages was granted for the extra time, this would absorb about £50,000,000 per annum of the extra £150,000,000 derived from 60 million tons additional exports, leaving a surplus of £100,000,000 yearly, which could be utilized to reduce the price of coal for industrial purposes, and bring down very considerably the charge for house coal. If this could be achieved, says Mr. Gilmour, British trade would have such an era of prosperity as we have never previously enjoyed.

Price of Gas at Silsden.—The price of gas at Silsden is to be advanced 10d. per 1000 c.ft.; and the local Council have decided to apply for power to increase the price by an additional 1s. per 1000 c.ft., if required. It was also resolved to raise the meter-rents.

Wages Rates of Romford Gas-Workers.—There was a threat to strike last Saturday week on the part of Romford gas-workers, in support of a demand that their wages should be increased to the London rates. A conference was held between representatives of the public authorities, the company, and the union; and as a result a strike was temporarily averted, and efforts made to reach a basis of agreement. The employers offered 4s. a week on the present pay; and the men asked for 10s. 6d. After several retirements, they reduced their demands to 5s.; but this was refused. Strike notices are now to operate on Saturday next.

Benzol Tank Fatality at Kingston.—While two men named Walker and Waterman were engaged in cleaning out a benzol tank at the Kingston-on-Thames depôt of the Anglo-American Oil Company, Walker was overcome by the fumes, and began to stagger about the tank. Waterman went to his assistance, and was also rendered unconscious, though in his case artificial respiration proved successful. Walker died within a few minutes of being rescued. On behalf of the Company, it was stated that the cleaning of the tank should not have been done by the workmen at Kingston, as they had properly trained men for the purpose.

Limerick Gas-Workers' Strike.—The Limerick gas-workers' strike has been settled on the basis of the Conciliation Board's award—10s. increase, with the introduction of machinery. The permanent staff's interests, however, to be preserved. The strike lasted a fortnight, and involved, of course, the shutting-down of the gas supply, to the great inconvenience of the public and consumers of all classes.

Primitiva Gas Company of Buenos Ayres, Ltd.—At the annual meeting next Tuesday, the Directors will submit the accounts of the Company for the year ended Dec. 31. These show a total loss for the year of £238,566, to which must be added the debit balance of profit and loss account at the end of 1918, £128,601, making a total debit of £367,167. As only 12,211 tons of coal could be obtained during the past year, the Company had to carbonize whatever substitutes they could secure. There were used 84,286 tons of timber, 12,591 tons of cereals, 1263 tons of gas oil, and a quantity of bones. These substitutes all cost considerably more than in the previous year. It has not been possible to make any provision for the Retiro amortization. As explained at the extraordinary general meeting last March, the ruinous contracts of 1909 and 1912 with the Municipality were cancelled, and a new contract for twenty years entered into on Jan. 14; while the new gas tariffs provided for in the contract were put into force on Feb. 1.

The gas plant, machinery, and fittings of the Cawood Gas Company (1917) are to be sold by public auction on June 17.

The Metropolitan-Vickers Electrical Company, Ltd., are to-day moving their London Office from the present address at No. 2, Norfolk Street, Strand, to No. 4, Central Buildings, Westminster, S.W. 1.

Accompanied by several members of the Urban District Council, Mr. Isaac Carr, of Widnes, paid a visit to the Withnell Gas-Works, and made an exhaustive examination of the plant. His report on the undertaking will be forwarded shortly.

The Markets Committee of the Derby Town Council report the receipt of complaints about the poor illuminating power of the gas supplied in the borough; and they state that they have instructed the Town Clerk to write to the Board of Trade on the matter.

Mr. Tom Dyson, Assistant Manager of the Longwood Gas-Works, and his fiancée were fortunate in escaping serious injury in a motoring accident in the Pateley Bridge District on May 23. A party of six were coming down a steep incline, when the brakes failed, and the car came to grief at a turn in the hill. Four of the occupants were thrown out; and two had to be taken to the Harrogate Infirmary and detained.

The Glasgow Corporation Gas Commissioners have accepted offers for benzol plant in connection with the Provan Chemical Works to the amount of £16,000. This includes three benzol rectification plants of 4000 gallons capacity apiece. Further offers amounting to £20,000 (odd) were accepted from the Barrowfield Iron-Works, Ltd., for four causticizers and two washers; and from other firms for two units of sulphate of ammonia plant.

There has been some correspondence between Messrs. W. & J. Glossop, Ltd., tar distillers, of Hipperholme, near Halifax, with respect to the sending of men into Ireland to execute contract work for the Bray District Council. The Council wrote the firm asking how it was the work was not being proceeded with; and Messrs. Glossop replied that, in the present unrestful state of the country, they did not see how they could incur the risk of sending any of their men. The Council thereupon said that politics should not be allowed to interfere with business arrangements, and denied that there was any risk. People who went about their own business were not molested.

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